

G06F

ELECTRICAL DIGITAL DATA PROCESSING (computers in which a part of the computation is effected hydraulically or pneumatically [G06D](#); optically [G06E](#); self-contained input or output peripheral equipment [G06K](#); impedance networks using digital techniques [H03H](#))

Definition statement

This subclass covers:

Electrical arrangements or processing means for the performance of any automated operation using empirical data in electronic form for classifying, analyzing, monitoring, or carrying out calculations on the data to produce a result or event.

References relevant to classification in this subclass

This subclass does not cover:

Programme-control systems	G05B 19/00
Digital computers in which all the computation is effected mechanically	G06C
Computers in which a part of the computation is effected hydraulically or pneumatically	G06D
Computers in which a part of the computation is effected optically	G06E
Computer systems based on specific computational models	G06N

Informative references

Attention is drawn to the following places, which may be of interest for search:

Self-contained input or output peripheral equipment	G06K
Impedance networks using digital techniques	H03H
Computer displays	G09G

Glossary of terms

In this subclass, the following terms (or expressions) are used with the meaning indicated:

Handling	includes processing or transporting of data.
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Data processing equipment	An association of an electric digital data processor classifiable under group G06F 7/00 , with one or more arrangements classifiable under groups G06F 1/00 - G06F 5/00 and G06F 9/00 - G06F 13/00 .
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G06F 1/00

Details of data-processing equipment not covered by groups [G06F 3/00](#) - [G06F 13/00](#), {e.g. cooling, packaging or power supply specially adapted for computer application (security arrangements for protecting computers or computer systems against unauthorised activity [G06F 21/00](#))}

References relevant to classification in this subclass

This group does not cover:

Security arrangements for protecting computers or computer systems against unauthorised activity	G06F 21/00
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Details of data-processing equipment	G06F 3/00 - G06F 13/00
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G06F 1/04

Generating or distributing clock signals or signals derived directly therefrom

Definition statement

This subgroup covers:

Generation and/or distribution of clock signal(s) within a computer system.

G06F 1/10

Distribution of clock signals {e.g. skew}

Definition statement

This subgroup covers:

Distribution of clock signal(s) within a computer system, in a typical case the goal to be achieved is to minimize the skew.

G06F 1/105

{in which the distribution is at least partially optical}

Definition statement

This subgroup covers:

Clock distribution wherein the clock signal(s) are distributed entirely optically or partially optically and partially electrically.

G06F 1/1603

{Arrangements to protect the display from incident light, e.g. hoods}

Special rules of classification within this group

Used also for hoods protecting displays of portable computers.

G06F 1/1607

{Arrangements to support accessories mechanically attached to the display housing ([G06F 1/1603](#), [G06F 1/1605](#) take precedence)}

Special rules of classification within this group

Used also for accessories attached on displays of portable computers.

G06F 1/1613

{for portable computers (cooling arrangements therefor [G06F 1/203](#); constructional details or arrangements for pocket calculators, electronic agendas or books [G06F 15/0216](#); constructional details of portable telephone sets: with several bodies [H04M 1/0202](#))}

Definition statement

This subgroup covers:

Portable computers in the sense of computers able to be used as stand alone computers with their own integrated user interface and designed to be carried by hand (e.g. hand held computers or laptop computers) or worn on the user's body (wearable computers).

Docking stations and extensions associated with the portable computers which may be mechanically attached to them.

Relationship between large subject matter areas

Telephone sets including user guidance or feature selection means facilitating their use: [H04M 1/247](#)

Cordless telephones: [H04M 1/725](#)

Pagers: [G08B 5/222](#)

References relevant to classification in this group

This subgroup does not cover:

Anti-theft locking devices	E05B 73/0082
Constructional details of cameras	G03B 17/00 , H04N 5/225
Cooling arrangements for portable computers	G06F 1/203
Constructional details or arrangements for pocket calculators, electronic agendas or books	G06F 15/0216
Hand held scanners	G06K 7/10881
Casing of remote controls	H01H 9/0235
Constructional details of portable telephone sets: with several bodies	H04M 1/0202

Special rules of classification within this group

In this field, main mechanical aspects of the housing (single housing, foldable or sliding housings) are classified in [G06F 1/1615](#) to [G06F 1/1626](#), while all the other constructional details (enclosure details, display, keyboard, integrated peripherals, etc) are classified in [G06F 1/1633](#) in complement to this main aspect.

Synonyms and Keywords

In patent documents the following words "Laptop", "Palmtop", "PDA" are often used as synonyms.

In patent documents the following words "cell phone", "mobile phone", "smart phone" are often used as synonyms.

G06F 1/1615

{with several enclosures having relative motions, each enclosure supporting at least one I/O or computing function (constructional details of portable telephones comprising a plurality of mechanically joined movable body parts [H04M 1/0206](#))}

Definition statement

This subgroup covers:

Portable computers having a plurality of enclosures which can't be classified in anyone of the subgroups, e.g. multiple enclosure with loose mechanical link

(single wire, expandable or/and flexible link, rollable part), computer split in several housings with no mechanical connection and wirelessly connected, complex mechanical link with multiple degrees of freedom.

Illustrative examples:

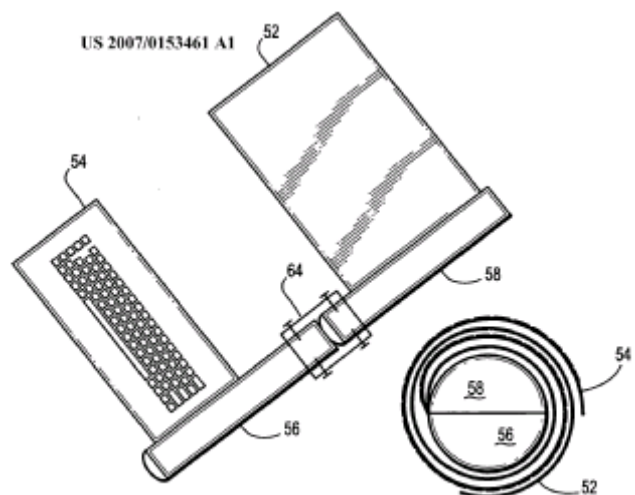
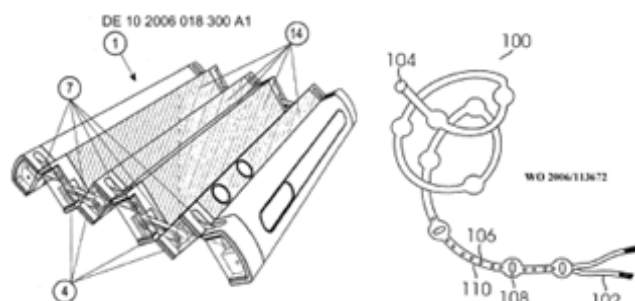
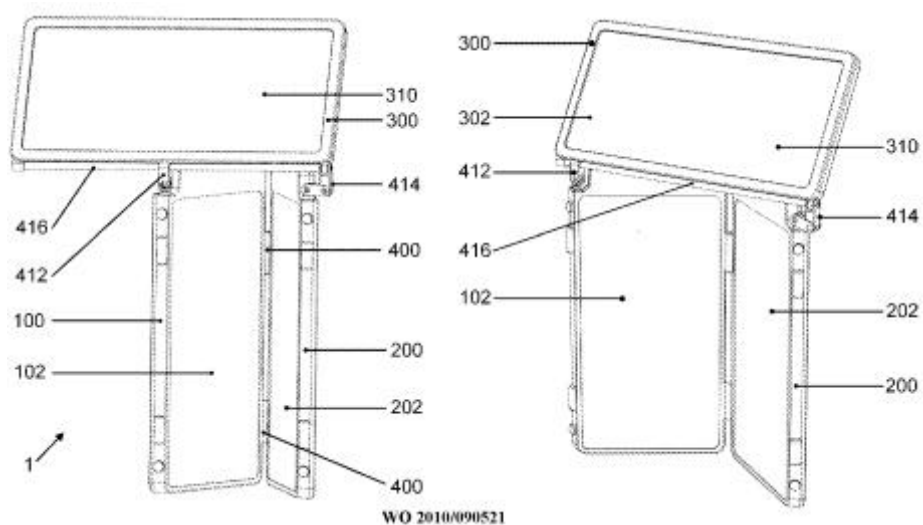


FIG. 5A

FIG. 5B



References relevant to classification in this subclass

This subgroup does not cover:

Constructional details of portable telephones comprising a plurality of mechanically joined movable body parts	H04M 1/0206
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G06F 1/1616

{with folding flat displays, e.g. laptop computers or notebooks having a clamshell configuration, with body parts pivoting to an open position around an axis parallel to the plane they define in closed position}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Foldable portable telephones	H04M 1/0214
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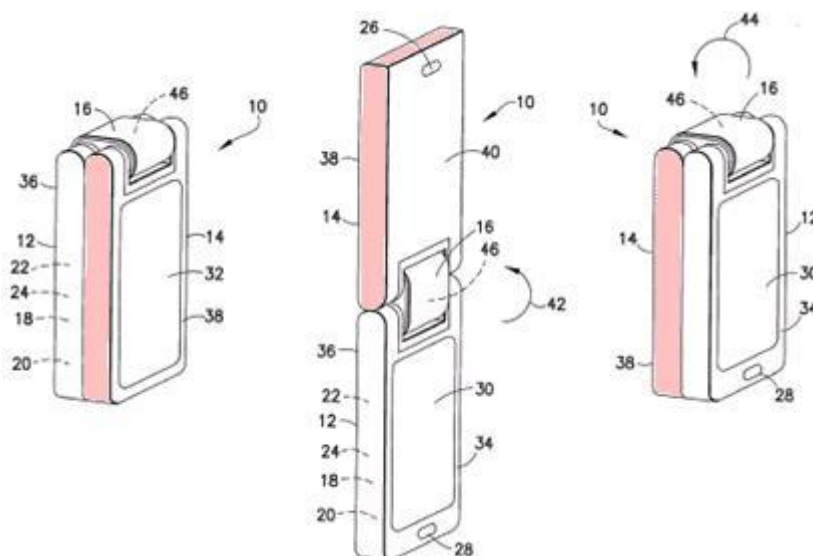
G06F 1/1618

{the display being foldable up to the back of the other housing with a single degree of freedom, e.g. by 360° rotation over the axis defined by the rear edge of the base enclosure}

Definition statement

This subgroup covers:

Also when the hinging part is composed of two parallel rotation axes.



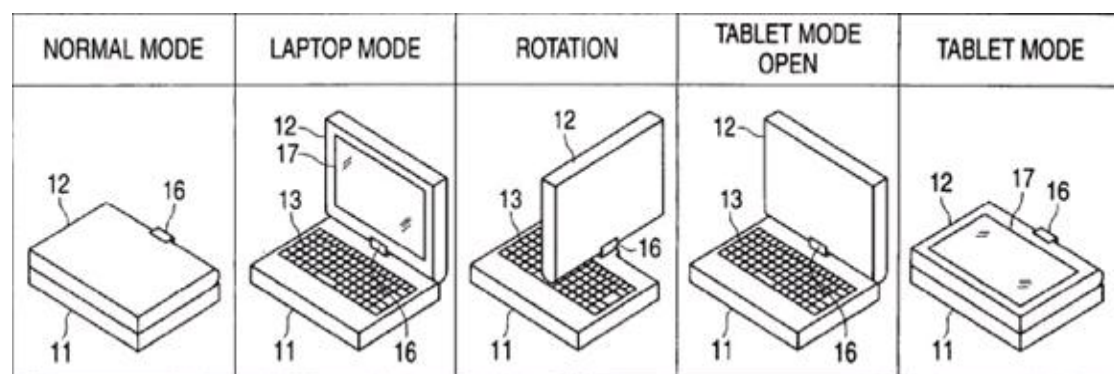
G06F 1/162

{changing, e.g. reversing, the face orientation of the screen with a two degrees of freedom mechanism, e.g. for folding into tablet PC like position or orienting towards the direction opposite to the user to show to a second user}

Definition statement

This subgroup covers:

Reversing the orientation done either by rotating along the X or Y axis or by detaching the display and attaching it in the reverse orientation. Illustrative example:



G06F 1/1622

{with enclosures rotating around an axis perpendicular to the plane they define or with ball-joint coupling, e.g. PDA with display enclosure orientation changeable between portrait and landscape by rotation with respect to a coplanar body enclosure}

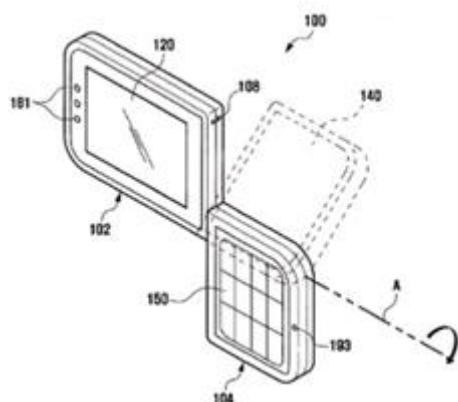
Definition statement

This subgroup covers:

Illustrative examples of subject matter classified in this group:



Additionally rotation around an axis common to the plane they define but perpendicular to their common side, e.g. reversing the relative orientation along an axis common to both planes but not along their sides (which would be then a folding axis).



References relevant to classification in this group

This subgroup does not cover:

Reversing the face orientation of the screen of a folding flat display	G06F 1/162
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Rotatable portable telephones	H04M 1/0225
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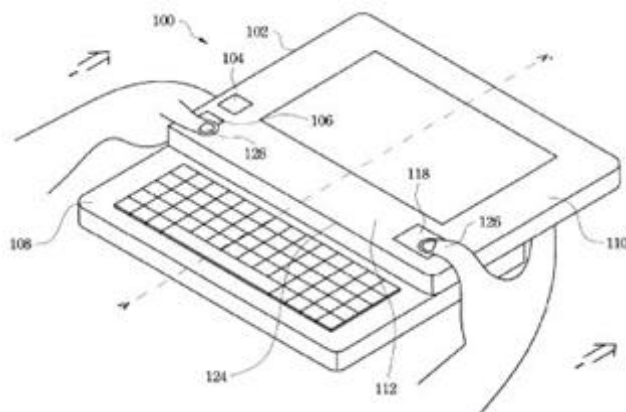
G06F 1/1624

{with sliding enclosures, e.g. sliding keyboard or display}

Definition statement

This subgroup covers:

Portable computers linked by a mechanism allowing translation of one housing relatively to the other housing.



Informative references

Attention is drawn to the following places, which may be of interest for search:

Slidable portable telephones	H04M 1/0235
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G06F 1/1628

{Carrying enclosures containing additional elements, e.g. case for a laptop and a printer}

Definition statement

This subgroup covers:

Also bags allowing the transport of other peripherals together with the portable computer and carrying trolleys for transporting portable computers.

References relevant to classification in this group

This subgroup does not cover:

Bags per se	A45C 3/00 - A45C 15/00
Stands with or without wheels as supports for apparatus	F16M 11/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Holders or carriers for hand articles	A45F 5/00
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G06F 1/163

{Wearable computers, e.g. on a belt}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Garnments adapted to accomodate electronic equipment	A41D 1/002
Fastening articles to garnments	A45F 5/02

G06F 1/1632

{External expansion units, e.g. docking stations}

Definition statement

This subgroup covers:

Expansions which are directly attached to portable computers, including supplementary battery packs external to the housing, port replicators and cradles for PDAs.

References relevant to classification in this group

This subgroup does not cover:

Standard wired or wireless peripherals such as keyboards, printers or displays which are not mechanically linked to a portable computer	B41J 1/00 , G06F 3/02 , G06F 1/1601
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Mounting in a car	B60R 11/02
Locking against unauthorized removal	E05B 73/0082
PCMCIA cards	H05K 5/0256
Battery charging cradles	H02J 7/0042

Synonyms and Keywords

In patent documents the following expressions/words "docking station", "cradle" and "port replicator" are often used as synonyms.

G06F 1/1633

{Constructional details or arrangements of portable computers not specific to the type of enclosures covered by groups [G06F 1/1615](#) - [G06F 1/1626](#)}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Mounting of specific components of portable telephones	H04M 1/026
Constructional details or arrangements of portable computers specific to the type of enclosures	G06F 1/1615 - G06F 1/1626

G06F 1/1635

{Details related to the integration of battery packs and other power supplies such as fuel cells or integrated AC adapter (details of mounting batteries in general [H01M 2/1022](#))}

References relevant to classification in this group

This subgroup does not cover:

Details of mounting batteries in general	H01M 2/1022
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Computer power supply in general	G06F 1/26
Portable telephones battery compartments	H04M 1/0262

G06F 1/1637

{Details related to the display arrangement, including those related to the mounting of the display in the housing (constructional details related to the housing of computer displays in general [G06F 1/1601](#))}

References relevant to classification in this group

This subgroup does not cover:

Constructional details related to the housing of computer displays in general	G06F 1/1601
Accessories mechanically attached to the display housing portion of portable computers	G06F 1/1603 - G06F 1/1611

Informative references

Attention is drawn to the following places, which may be of interest for search:

Portable telephones display	H04M 1/0266
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G06F 1/1641

{the display being formed by a plurality of foldable display components ([G06F 1/1647](#) takes precedence)}

References relevant to classification in this group

This subgroup does not cover:

Including at least an additional display	G06F 1/1647
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Special rules of classification within this group

Should be used when the displays are used in combination as a virtual single display area where the displayed image is split over the display screens.

G06F 1/1647

{including at least an additional display ([G06F 1/1692](#) takes precedence)}

References relevant to classification in this group

This subgroup does not cover:

Constructional details or arrangements related to integrated I/O peripheral being a secondary touch screen used as control interface, e.g. virtual buttons or sliders	G06F 1/1692
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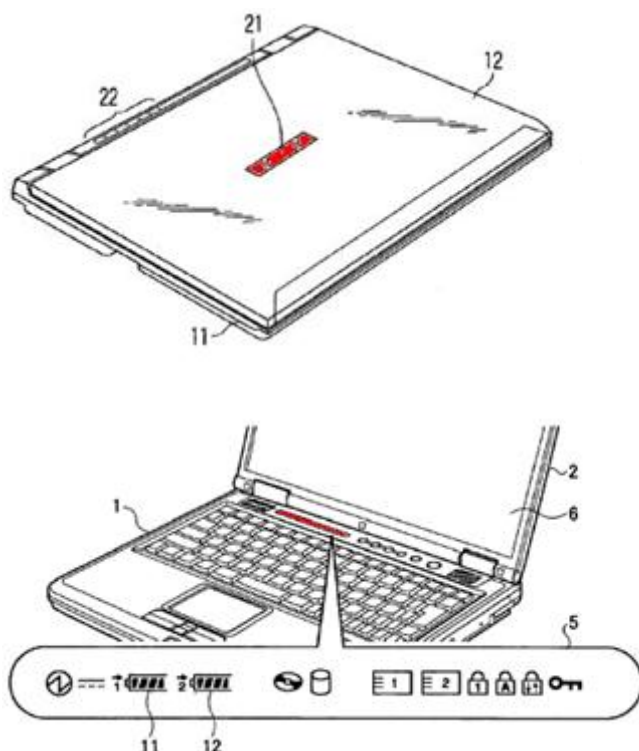
G06F 1/165

{the additional display being small, e.g. for presenting status information}

Definition statement

This subgroup covers:

Typically very small displays disposed on the back of the main display for indicating time, alerts or battery level or small status displays near the hinge above the keyboard. Illustrative examples:



G06F 1/1652

{the display being flexible, e.g. mimicking a sheet of paper, or rollable}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Portable telephones flexible display	H04M 1/0268
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G06F 1/1656

{Details related to functional adaptations of the enclosure, e.g. to provide protection against EMI, shock, water, or to host detachable peripherals like a mouse or removable expansions units like PCMCIA cards, or to provide access to internal components for maintenance or to removable storage supports like CDs or DVDs, or to mechanically mount accessories (mounting of accessories to a computer display [G06F 1/1607](#); display hoods [G06F 1/1603](#); cooling arrangements for portable computers [G06F 1/203](#))}

References relevant to classification in this group

This subgroup does not cover:

Accessories mechanically attached to the display housing portion of portable computers	G06F 1/1603 - G06F 1/1611
Enclosure details of non portable computers	G06F 1/181
Cooling arrangements for portable computers	G06F 1/203

Informative references

Attention is drawn to the following places, which may be of interest for search:

Portable telephones with mechanically detachable module(s)	H04M 1/0254
Portable telephones with improved resistance to shocks	H04M 1/185

G06F 1/1658

{related to the mounting of internal components, e.g. disc drive or any other functional module}

References relevant to classification in this group

This subgroup does not cover:

Internal mounting structures of non portable computers	G06F 1/183
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G06F 1/1662**{Details related to the integrated keyboard}****Informative references***Attention is drawn to the following places, which may be of interest for search:*

Details of stand alone keyboards	G06F 3/0202
Constructional details of keyboard switches	H01H 13/70
Portable telephones keypads	H04M 1/23

G06F 1/1673**{Arrangements for projecting a virtual keyboard}****Informative references***Attention is drawn to the following places, which may be of interest for search:*

Digitisers	G06F 3/041
Interaction with virtual keyboards displayed on a touch sensitive surface	G06F 3/04886

G06F 1/1675**{Miscellaneous details related to the relative movement between the different enclosures or enclosure parts which could be adopted independently from the movement typologies specified in [G06F 1/1615](#) and subgroups}****References relevant to classification in this group***This subgroup does not cover:*

Movement typologies	G06F 1/1615
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Informative references*Attention is drawn to the following places, which may be of interest for search:*

Relative motion of the body parts to change the operational status of the portable telephone	H04M 1/0241
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G06F 1/1677

{for detecting open or closed state or particular intermediate positions assumed by movable parts of the enclosure, e.g. detection of display lid position with respect to main body in a laptop, detection of opening of the cover of battery compartment}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Portable telephones open/close detection	H04M 1/0245
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G06F 1/1681

{Details related solely to hinges (hinge details related to the transmission of signals or power are classified in [G06F 1/1683](#))}

References relevant to classification in this group

This subgroup does not cover:

Hinge details related to the transmission of signals or power	G06F 1/1683
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Hinges for doors, windows or wings	E05D 1/00 - E05D 15/00
Portable telephones hinge details	H04M 1/0216 , H04M 1/0227 , H04M 1/0237

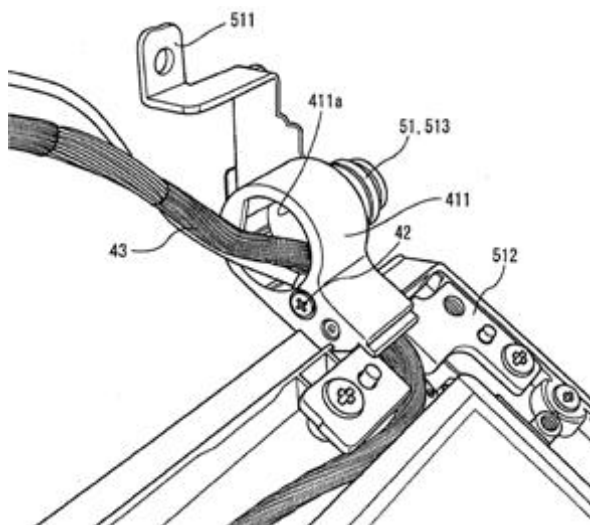
G06F 1/1683

{for the transmission of signal or power between the different housings, e.g. details of wired or wireless communication, passage of cabling}

Definition statement

This subgroup covers:

Also optical transmission of data or inductive transmission of power between housings.



G06F 1/1686

{the I/O peripheral being an integrated camera}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Camera details of portable telephones	H04M 1/0264
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G06F 1/1688

{the I/O peripheral being integrated loudspeakers}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Mounting aspects of transmitters in portable telephones	H04M 1/03
Loudspeakers	H04R 1/00

G06F 1/169

{the I/O peripheral being an integrated pointing device, e.g. trackball in the palm rest area, mini-joystick integrated between keyboard keys, touch pads or touch stripes ([G06F 1/1643](#) takes precedence; constructional details of pointing devices [G06F 3/033](#); joysticks in general [G05G 9/047](#))}

References relevant to classification in this group

This subgroup does not cover:

Joysticks in general	G05G 9/047
Touchscreens	G06F 1/1643 , G06F 1/1692
Constructional details of pointing devices	G06F 3/033

Informative references

Attention is drawn to the following places, which may be of interest for search:

Constructional details of pointing devices in portable telephones	H04M 1/233
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G06F 1/1692

{the I/O peripheral being a secondary touch screen used as control interface, e.g. virtual buttons or sliders}

Definition statement

This subgroup covers:

Secondary touchscreens which are used only as input device (touchpad, virtual input devices), and not for information display.

G06F 1/1694

{the I/O peripheral being a single or a set of motion sensors for pointer control or gesture input obtained by sensing movements of the portable computer}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Gestural input	G06F 3/017
Motion sensing in space for computer input	G06F 3/0346

G06F 1/1696

{the I/O peripheral being a printing or scanning device}

Definition statement

This subgroup covers:

Scanners for e.g. A4 sheets.

References relevant to classification in this group

This subgroup does not cover:

Barcode readers	G06K 7/10861 , G06K 7/10821
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Scanners	G06K 7/10 , H04N 1/00
Printers	G06K 15/00 , B41J 1/00

G06F 1/1698

{the I/O peripheral being a sending/receiving arrangement to establish a cordless communication link, e.g. radio or infrared link, integrated cellular phone (details of antennas disposed inside a computer [H01Q 1/2266](#))}

References relevant to classification in this group

This subgroup does not cover:

details of antennas disposed inside a computer	H01Q 1/2266
Interaction of portable devices with video on demand or television systems	H04N 21/4126 , H04N 21/41407 , H04N 5/4403

Informative references

Attention is drawn to the following places, which may be of interest for search:

Aerials	H01Q
Cordless telephones	H04M 1/725

G06F 1/18

Packaging or power distribution {(for electrical apparatus in general [H05K](#), [H02J](#))}

Definition statement

This subgroup covers:

Cases and housing for computers and how computer components are "packed" , i.e. mounted within the housing . It also covers arrangements, e.g. cabling, to distribute the power generated by the power supply unit to the other computer components mounted within the casing.

References relevant to classification in this group

This subgroup does not cover:

Cases or housings of portable computers	G06F 1/1613
Cases or housings for electrical apparatuses in general	H05K , H02J

G06F 1/181

{Enclosures (for electric apparatus in general [H05K 5/00](#); for portable computers [G06F 1/1613](#))}

Definition statement

This subgroup covers:

Enclosures for computers, including constructional details of front or bezel.

References relevant to classification in this group

This subgroup does not cover:

Enclosures for portable computers	G06F 1/1613
Enclosures for electrical apparatuses in general	H05K 5/00

G06F 1/182

{with special features, e.g. for use in industrial environments; grounding or shielding against radio frequency interference [RFI] or electromagnetic interference [EMI] (in general [H05K 9/00](#))}

Definition statement

This subgroup covers:

Enclosures for non-standard computers, e.g. industrial computers, computers specifically adapted to special environments.

References relevant to classification in this group

This subgroup does not cover:

Shielding against electromagnetic interference in general	H05K 9/00
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G06F 1/183

{Internal mounting support structures, e.g. for printed circuit boards (in general [H05K 7/1422](#)), internal connecting means (for buses [G06F 13/409](#))}

Definition statement

This subgroup covers:

Mounting structures for securing and/or interconnecting among them internal components within the enclosure of a computer system.

References relevant to classification in this group

This subgroup does not cover:

Mounting structures for printed circuits in general	H05K 7/1422
Internal connecting means for buses	G06F 13/409
Internal mounting structures for portable computers	G06F 1/1656

G06F 1/185

{Mounting of expansion boards (in general [H05K 7/1417](#))}

References relevant to classification in this group

This subgroup does not cover:

Mounting of expansion boards in general	H05K 7/1417
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Special rules of classification within this group

Used for the securing of expansion cards completely within the enclosure, and not to the connection to openings in the enclosure.

G06F 1/186

{Securing of expansion boards in correspondence to slots provided at the computer enclosure (in general [H05K 7/1402](#))}

References relevant to classification in this group

This subgroup does not cover:

Securing of expansion boards in general	H05K 7/1402
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Special rules of classification within this group

Used for to the connection of expansion boards to openings in the enclosure so that at least a portion, or connector, of the expansion board is accessible from outside the enclosure.

G06F 1/187

{Mounting of fixed and removable disk drives (constructional details of disk drives housings in general [G11B 33/00](#))}

References relevant to classification in this group

This subgroup does not cover:

Constructional details of disk drives housings in general	G11B 33/00
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Special rules of classification within this group

Used for both optical drives and hard disk drives.

G06F 1/206

{comprising thermal management}

Special rules of classification within this group

This groups refers also to documents wherein the thermal management is achieved by lowering power consumption in order to reduce heat generation..

Documents also disclosing constructional details about the managed cooling arrangement should be also classified in [G06F 1/20](#) if describing the cooling of a desktop computer or [G06F 1/203](#) if describing the cooling of a portable computer.

G06F 1/26

Power supply means, e.g. regulation thereof (for memories [G11C](#); {regulation in general [G05F](#)})

Definition statement

This subgroup covers:

Power supplies for computers including:

- Power regulation;
- Power monitoring including means for acting in the event of power supply fluctuations or interruption;
- Power save.

References relevant to classification in this group

This subgroup does not cover:

Power supplies in general	G05F
Power supplies for memories	G11C

G06F 1/263

{Arrangements for using multiple switchable power supplies, e.g. battery and AC ([G06F 1/30](#) takes precedence)}

Definition statement

This subgroup covers:

Arrangements with switchable, multiple power supplies (typical example is AC and battery, but may also include multiple batteries, fuel cells or solar panels).

References relevant to classification in this group

This subgroup does not cover:

Means for acting in the event of power-supply failure or interruption, e.g. power-supply fluctuations	G06F 1/30
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G06F 1/266

{Arrangements to supply power to external peripherals either directly from the computer or under computer control, e.g. supply of power through the communication port, computer controlled power-strips}

Definition statement

This subgroup covers:

Arrangements to supply power to external peripherals, either directly from the computer or under computer control (typical cases are the supply of power through a USB interface and the power strips).

G06F 1/28

Supervision thereof, e.g. detecting power-supply failure by out of limits supervision

Definition statement

This subgroup covers:

Arrangements to monitor, and only monitoring, power supply parameters (e.g. voltage and/or current).

References relevant to classification in this group

This subgroup does not cover:

Means for acting in the event of power-supply failure or interruption, e.g. power-supply fluctuations	G06F 1/30 , G06F 1/305
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G06F 1/32

Means for saving power

Definition statement

This subgroup covers:

Means to save power in computers, including devices, methods and combinations of devices and method features.

G06F 1/3203

{Power Management, i.e. event-based initiation of power-saving mode}

Definition statement

This subgroup covers:

Power saving having a relationship to an event of any type. As opposed to arrangements and/or methods to save power of permanent or continuous nature.

G06F 1/3206

{Monitoring a parameter, a device or an event triggering a change in power modality}

Definition statement

This subgroup covers:

Power saving triggered by a certain event and/or condition detected by monitoring or supervision of e.g. hardware, communication, processing tasks.

G06F 1/3215

{Monitoring of peripheral devices}

Special rules of classification within this group

Used when the peripheral monitored does not belong to any of the subgroups: [G06F 1/3218](#), [G06F 1/3221](#) or [G06F 1/3225](#).

G06F 1/3228

{Monitoring task completion, e.g. by use of idle timer, STOP command, WAIT command}

Definition statement

This subgroup covers:

Power saving initiated when a task completion is detected (typical cases are the completion of processing tasks, e.g. programs, applications, routines).

G06F 1/3231

{Monitoring user presence or absence}

Definition statement

This subgroup covers:

Power saving initiated when the user absence is detected, e.g. through camera and/or sensors.

Special rules of classification within this group

Not to be used when the user absence is inferred by inactivity period (subgroups referring to monitoring of peripheral devices to be used in such cases: [G06F 1/3215](#), etc).

G06F 1/3237

{Power saving by disabling clock generation or distribution}

Definition statement

This subgroup covers:

Power saving by stopping clock generation or distribution to a computer or a component.

G06F 1/3243

{Power saving in micro controller unit}

Definition statement

This subgroup covers:

Power saving taking place in the processing unit of the computer, intended as central processing unit (CPU), micro controller unit (MCU), microprocessor.

G06F 1/3256

{Power saving in optical drive}

Definition statement

This subgroup covers:

Power saving in optical (or magneto-optical) disk drives, e.g. CD, DVD, Blue-Ray, etc.

G06F 1/3268

{Power saving in hard disk drive}

References relevant to classification in this group

This subgroup does not cover:

Power saving in storage systems (e.g. not in disk drives within a computer system)	G06F 3/0625
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G06F 1/3287

{Power saving by switching off individual functional units in a computer system, i.e. selective power distribution}

Definition statement

This subgroup covers:

Power saving by selectively reducing power consumption of individual components of a computer system. Such reduction can be achieved in different ways, e.g. by lowering the clock frequency or stopping the clock, by lowering the voltage, by stopping the power supply (power gating).

G06F 3/00

Input arrangements for transferring data to be processed into a form capable of being handled by the computer; Output arrangements for transferring data from processing unit to output unit, e.g. interface arrangements (typewriters [B41J](#); conversion of physical variables [F15B 5/00](#), [G01](#); image acquisition [G06T 1/00](#), [G06F 9/00](#); coding, decoding or code conversion in general [H03M](#); transmission of digital information [H04L](#); {in regulating or control systems [G05B](#)})

Definition statement

This group covers:

Input arrangements which are not covered in specific subgroups under it in the hierarchy

Informative references

Attention is drawn to the following places, which may be of interest for search:

Typewriters	B41J
Conversion of physical variables	F15B 5/00 , G01
Image acquisition	G06T 1/00 , G06F 9/00

Coding, decoding or code conversion in general	H03M
Transmission of digital information	H04L
In regulating or control systems	G05B

G06F 3/002

{Specific input/output arrangements not covered by [G06F 3/02](#) - [G06F 3/16](#), e.g. facsimile, microfilm (facsimile per se [H04N 1/00](#); viewers photographic printing [G03B](#); electrography, magnetography [G03G](#); other optical apparatus [G02B 27/00](#))}

Definition statement

This subgroup covers:

Includes inter alia arrangements in which a barcode reader is used to input data to a computer and in particular drivers for barcode or QR code readers.

Due to the later creation of [G06F 3/01](#) groups, the title should be understood as I/O arrangements not covered by [G06F 3/01](#) to [G06F 3/16](#), instead of [G06F 3/02](#) to [G06F 3/16](#).

Relationship between large subject matter areas

Recognition of data; presentation of data; record carriers; handling record carriers: [G06K](#).

References relevant to classification in this group

This subgroup does not cover:

Detection of the position or the displacement of a tangible user interface as a computer input	G06F 3/03
Other optical apparatus	G02B 27/00
Viewers photographic printing	G03B
Electrography, magnetography	G03G
Constructional details of barcode readers	G06K 7/00
Reading of RFID record carriers	G06K 7/0008
Constructional details of RFID record carriers	G06K 19/07749
Use of barcode readers or RFIDs in data processing systems for business applications	G06Q
Wireless phone using NFC or a two-way short-range wireless interface	H04M 1/7253
Facsimile per se	H04N 1/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Specific input/output arrangements	G06F 3/02- G06F 3/16
Viewers photographic printing	G03B
Electrography, magnetography	G03G

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

TUI	a user interface in which a person interacts with digital information through a physical environment, i.e. by manipulating physical objects (e.g. in the same way as moving pieces of a game on a tablet), often using RFID or NFC.
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Synonyms and Keywords

In patent documents the following abbreviations are often used:

TUI	Tangible User Interface
RFID	Radio-Frequency Identification
NFC	Near Field Communication

G06F 3/005

{Input arrangements through a video camera}

Definition statement

This subgroup covers:

Specific arrangements for input through a video camera, not covered by [G06F 3/01](#) to [G06F 3/16](#), e.g. details of the interface linking the camera to the computer.

This group was originally meant for devices adapting analog video cameras to computer entry.

References relevant to classification in this group

This subgroup does not cover:

Tracking user body for computer input	G06F 3/011 , G06F 3/017
Pointing device integrating a camera for tracking its own position with respect to an imaged reference surface or the surroundings	G06F 3/0304
Tracking a projected light spot generated by a light pen or a "laser pointer" indicating a position on a display surface	G06F 3/0386
Digitisers using a camera for tracking the position of objects with respect to an imaged reference surface	G06F 3/042
Recognising movements or behaviour, e.g. recognition of gestures, dynamic facial expressions; Lip-reading	G06K 9/00335
Television cameras	H04N 5/225

G06F 3/007

{Digital input from or digital output to memories of the shift register type, e.g. magnetic bubble memories, CCD memories (magnetic bubble memories per se [G11C 19/08](#), CCD memories per se [G11C 19/28](#))}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Digital input from or digital output to record carriers	G06F 3/06
Magnetic bubble memories per se	G11C 19/08
Shift registers, C-C-D memories per se	G11C 19/28
Organisation of a multiplicity of shift registers	G11C 19/287

Special rules of classification within this group

Old technology, not used anymore.

G06F 3/01

Input arrangements or combined input and output arrangements for interaction between user and computer ([G06F 3/16](#) takes precedence)

References relevant to classification in this group

This subgroup does not cover:

Sound input, sound output including multimode user input, i.e. combining audio input (e.g. voice input) with other user input	G06F 3/16
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G06F 3/011

{Arrangements for interaction with the human body, e.g. for user immersion in virtual reality (for handicapped people in general [A61F 4/00](#); robot control [B25J](#); tactile signalling [G08B](#); blind teaching [G09B 21/00](#); for electrophonic musical instruments [G10H 1/344](#); electronic switches characterised by the way in which the control signals are generated [H03K 17/94](#))}

Relationship between large subject matter areas

Diagnosis; surgery; identification: [A61B](#)

Recognition of data; presentation of data; record carriers; handling record carriers: [G06K](#)

References relevant to classification in this group

This subgroup does not cover:

Measuring of parameters or motion of the human body or parts thereof for diagnostic purposes	A61B 5/00
For handicapped people in general	A61F 4/00
Games using an electronically generated display and player-operated input means	A63F 13/20
Robot control	B25J
Stereoscopic optical systems	G02B 27/22
Acquiring or recognising human faces, facial parts, facial sketches, facial expressions	G06K 9/00221
Recognising human body or animal bodies	G06K 9/00362
Tactile signalling	G08B
Blind teaching	G09B 21/00

Virtual reality arrangements for interacting with music, including those with tactile feedback	G10H 1/00
For electrophonic musical instruments	G10H 1/344
Electronic switches characterised by the way in which the control signals are generated	H03K 17/94

G06F 3/012

{Head tracking input arrangements}

Definition statement

This subgroup covers:

For the scope of this group, Head-tracking is interpreted as covering face detection and tracking.

References relevant to classification in this group

This subgroup does not cover:

Head-tracking for image generation in head-mounted display	G02B 27/0093 , G02B 27/01
Use of head-tracking for image generation	G06T 7/00 , G06T 11/00
3D image generation in augmented reality	G06T 19/006
Stereoscopic picture reproducers using observer tracking	H04N 13/0468

Synonyms and Keywords

In patent documents the following abbreviations are often used:

HMD	Head-Mounted Display
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G06F 3/013

{Eye tracking input arrangements ([G06F 3/015](#) takes precedence)}

References relevant to classification in this group

This subgroup does not cover:

Apparatus for testing the eyes and instruments for examining the eyes	A61B 3/00
Instruments for determining or recording eye movement	A61B 3/113

Based on nervous system activity detection	G06F 3/015
Acquiring or recognising eyes	G06K 9/00597

Synonyms and Keywords

In patent documents the following expressions/words "eye tracking" and "gaze tracking" are often used as synonyms.

G06F 3/014

{Hand-worn input/output arrangements, e.g. data gloves}

Definition statement

This subgroup covers:

Also covers hand-worn keyboards

Relationship between large subject matter areas

Manipulators; chambers provided with manipulation devices: [B25J](#)

References relevant to classification in this group

This subgroup does not cover:

Finger worn arrangements for converting the position or the displacement of a member into a coded form	G06F 3/03 , G06F 2203/0331
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Data glove (sometimes called a "wired glove" or "cyberglove")	an input device for human–computer interaction worn like a glove
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G06F 3/015

{Input arrangements based on nervous system activity detection, e.g. brain waves [EEG] detection, electromyograms [EMG] detection, electrodermal response detection}

References relevant to classification in this group

This subgroup does not cover:

Detecting bioelectric signals for diagnostic purpose	A61B 5/0006 , A61B 5/04
Bioelectrical control, e.g. myoelectric	A61F 2/72

G06F 3/016

{Input arrangements with force or tactile feedback as computer generated output to the user}

Definition statement

This subgroup covers:

Dynamic force or tactile feedback arrangements. Also passive feedback arrangements but only if they are dynamically reconfigurable under computer control, e.g. buttons raised from a touchpad surface using electronic muscle or similar.

Relationship between large subject matter areas

- Manipulators; chambers provided with manipulation devices: [B25J](#)
- Conjoint control of vehicle sub-units of different type or different function; control systems specially adapted for hybrid vehicles; road vehicle drive control systems for purposes not related to the control of a particular sub-unit: [B60W](#)
- Systems acting by means of fluids; fluid-pressure actuators, e.g. servo-motors: [F15B](#)
- Control or regulating systems in general: [G05B](#)
- Mechanical control devices: [G05G](#)

References relevant to classification in this group

This subgroup does not cover:

Hand grip control means for manipulators	B25J 13/02
Tactile feedback for vehicle driver	B60W 50/16
Servo-motor systems giving the operating person a "feeling" of the response of the actuated device:	F15B 13/14

Means for enhancing the operator's awareness of arrival of the controlling member (knob, handle) at a command or datum position; Providing feel, e.g. means for creating a counterforce	G05G 5/03
Passive (and non reconfigurable) feedback arrangements on a touchscreen, e.g. overlays with reliefs for indicating keys of a virtual keyboard	G06F 3/04886
Tactile presentation of information , e.g. Braille display	G09B 21/001
Keyboards characterised by tactile feedback features	H01H 13/85
Piezoelectric actuators	H01L 41/09

G06F 3/017

{Gesture based interaction, e.g. based on a set of recognized hand gestures (interaction based on gestures traced on a digitiser [G06F 3/04883](#))}

Definition statement

This subgroup covers:

Gesture interaction as a sequence and/ or a combination of user movements captured using various sensing techniques such as (among others) cameras monitoring the user, arrangements for interaction with the human body, input by means of a device moved freely in 3D space or opto-electronic detection arrangements.

References relevant to classification in this group

This subgroup does not cover:

Gestures made on the surface of a digitiser and/or in close proximity to this surface for digitisers capable of touchless position sensing and/or measuring also the distance in the Z direction	G06F 3/04883
Acquiring or recognising (static) human faces, facial parts, facial sketches, facial expressions	G06K 9/00221
Recognising movements or behaviour, e.g. recognition of gestures, dynamic facial expressions; Lip-reading	G06K 9/00335
Lip-reading assisted speech recognition	G10L 15/24

Informative references

Attention is drawn to the following places, which may be of interest for search:

Arrangements for interaction with the human body:	G06F 3/011
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Input by means of (pointing) device or object moved freely in 3D space	G06F 3/0346
Detection arrangements using opto-electronic means	G06F 3/0304

Special rules of classification within this group

The sensing technique as such should be also classified in the relevant class if necessary (non trivial technique).

G06F 3/018

{Input/output arrangements for oriental characters}

Relationship between large subject matter areas

Handling natural language data: [G06F 17/20](#)

References relevant to classification in this group

This subgroup does not cover:

Inputting characters	G06F 3/0233
Non-Latin character encoding in text processing, e.g. kana-to-kanji conversion	G06F 17/2223
Processing of non- latin text	G06F 17/2863

G06F 3/02

Input arrangements using manually operated switches, e.g. using keyboards or dials (keyboard switches per se [H01H 13/70](#); electronic switches characterised by the way in which the control signals are generated [H03K 17/94](#))

Definition statement

This subgroup covers:

Input arrangements using manually operated switches, e.g. using keyboards or dials, insofar as they are stand-alone devices or integrated in a fixed computer system. Includes wired or wireless keyboards which are not mechanically linked to a portable computer.

Relationship between large subject matter areas

- Electric switches; relays; selectors; emergency protective device: [H01H](#)
- Pulse technique: [H03K](#)

References relevant to classification in this group

This subgroup does not cover:

Details related to integrated keyboard of portable computers	G06F 1/1662
Keyboard switches per se	H01H 13/70
Electronic switches characterised by the way in which the control signals are generated	H03K 17/94

G06F 3/0202

{Constructional details or processes of manufacture of the input device}

References relevant to classification in this group

This subgroup does not cover:

Palm(wrist)-rests not integrated in the keyboard	A47B 21/0371
Wrist worn wrist rests	A61F 5/0118
Document holders for typewriters	B41J 29/15
Input/Output devices for watches	G04G 21/00
Special layout of keys	G06F 3/0219 , G06F 3/0219
Switches having rectilinearly-movable operating part or parts	H01H 13/00
Constructional details of keyboards having such switches	H01H 13/70
Details of keys/push buttons	H01H 3/12
Electronic switching or gating i.e. not by contact-making or -braking	H03K 17/00
Proximity switches	H03K 17/945
Touch switches with electronic switching	H03K 17/96
Keyboard, i.e. having a plurality of control members, with electronic switching	H03K 17/967
With optoelectronic devices	H03K 17/969
Capacitive touch switches	H03K 17/962
Force resistance transducer	H03K 17/9625
Optical touch switches	H03K 17/9627
Piezo-electric touch switches	H03K 17/964
Resistive touch switches	H03K 17/9645

With magnetic movable elements	H03K 17/972
With capacitive movable elements	H03K 17/98

Synonyms and Keywords

In patent documents the following abbreviations are often used:

RSI	Repetitive Stress Injuries
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G06F 3/0205

{Lever arrangements for operating keyboard cursor control keys in a joystick-like manner}

References relevant to classification in this group

This subgroup does not cover:

Joysticks with a pivotable rigid stick	G05G 9/047
Integration of a mini joystick in a portable computer	G06F 1/169
Integration of a mini joystick in a keyboard	G06F 3/0213
Details of the interface with a computer	G06F 3/038

G06F 3/0208

{Arrangements for adjusting the tilt angle of a keyboard, e.g. pivoting legs (for keyboards integrated in a laptop computer [G06F 1/1667](#))}

References relevant to classification in this group

This subgroup does not cover:

Adjusting the tilt angle of the integrated keyboard in a mobile computer	G06F 1/1667
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G06F 3/021

{Arrangements integrating additional peripherals in a keyboard, e.g. card or barcode reader, optical scanner}

References relevant to classification in this group

This subgroup does not cover:

Constructional details of barcode readers	G06K 7/00
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G06F 3/0213

{Arrangements providing an integrated pointing device in a keyboard, e.g. trackball, mini-joystick (for pointing devices integrated in a laptop computer [G06F 1/169](#); joysticks [G05G 9/047](#); constructional details of pointing devices [G06F 3/033](#))}

References relevant to classification in this group

This subgroup does not cover:

Joysticks with a pivotable rigid stick	G05G 9/047
Integration of a mini joystick in a portable computer	G06F 1/169
Constructional details of pointing devices	G06F 3/033

G06F 3/0216

{Arrangements for ergonomically adjusting the disposition of keys of a keyboard (for keyboards integrated in a laptop computer [G06F 1/1664](#))}

References relevant to classification in this group

This subgroup does not cover:

For keyboards integrated in a laptop computer	G06F 1/1664
Keyboards characterised by ergonomic functions, e.g. for miniature keyboards	H01H 13/84

G06F 3/0219

{Special purpose keyboards}

Definition statement

This subgroup covers:

Any keyboard designed or modified to control a specific software application or specific hardware, e.g. by integrating dedicated keys. Key layouts in alternative to the QWERTY standard are also classified in this group.

References relevant to classification in this group

This subgroup does not cover:

Devices for teaching typing	G09B 13/00
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G06F 3/0221

{Arrangements for reducing keyboard size for transport or storage, e.g. foldable keyboards, keyboards with collapsible keys ([G06F 3/0216](#) takes precedence; for keyboards integrated in a laptop computer [G06F 1/1666](#))}

References relevant to classification in this group

This subgroup does not cover:

Arrangements for reducing the size of the integrated keyboard in a portable computer	G06F 1/1666
Arrangements for ergonomically adjusting the disposition of keys of a keyboard	G06F 3/0216
Keyboards characterised by the casing, e.g. sealed casings or casings reducible in size	H01H 13/86

G06F 3/0224

{Key guide holders}

References relevant to classification in this group

This subgroup does not cover:

Document holders for typewriters	B41J 29/15
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G06F 3/0227

{Cooperation and interconnection of the input arrangement with other functional units of a computer ([G06F 3/023](#) - [G06F 3/037](#) take precedence)}

Definition statement

This subgroup covers:

Input arrangements using manually operated switches, e.g. using keyboards or dials, further comprising cooperation and interconnection of the input arrangement with other functional units of a computer.

References relevant to classification in this group

This subgroup does not cover:

Keyboards integrating additional peripherals	G06F 3/021
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Arrangements for converting discrete items of information into a coded form. Arrangements for converting the position or the displacement of a member into a coded form	G06F 3/023- G06F 3/037
Arrangements for converting the position or the displacement of a member into a coded form	G06F 3/03

G06F 3/023

Arrangements for converting discrete items of information into a coded form, e.g. arrangements for interpreting keyboard generated codes as alphanumeric codes, operand codes or instruction codes {(coding in connection with keyboards or like devices in general [H03M 11/00](#))}

Definition statement

This subgroup covers:

Keyboard interfaces and drivers; peripherals emulating a keyboard (e.g. producing "keystroke input" signals); devices providing additional buttons or foot operated switches and connected between keyboard and PC.

Also comprises KVM switches.

References relevant to classification in this group

This subgroup does not cover:

Virtual keyboards displayed on a touchscreen	G06F 3/04886
Coding in connection with keyboards, i.e. coding of the position of operated keys	H03M 11/00

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

KVM	a KVM switch allows a user to control one or multiple computer(s) from one or multiple KVM device(s)
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Synonyms and Keywords

In patent documents the following abbreviations are often used:

KVM	Keyboard, Video, Mouse
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G06F 3/0231

{Cordless keyboards}

Definition statement

This subgroup covers:

Costructional details related to the wireless link, e.g. position of the IR transmitter/receiver as well as protocol details for the wireless trasmission of keyboard codes.

References relevant to classification in this group

This subgroup does not cover:

Means for saving power, monitoring of peripheral devices	G06F 1/325
Information transfer between I/O devices and CPU, e.g. on bus	G06F 13/38

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Cordless keyboards	wireless keyboards; they are also often called according to the technology used: infrared keyboard, radio keyboard, wlan keyboard, bluetooth keyboard
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G06F 3/0232

{Manual direct entries, e.g. key to main memory}

Special rules of classification within this group

Old technology, not used anymore.

G06F 3/0233

{Character input methods}

Definition statement

This subgroup covers:

Character input using a reduced number of keys, e.g. with respect to the alphabet, i.e. multivalued keys. Covers character input methods wherein a character is entered by tracing it on a matrix of switches (keys). Covers

character input methods where a character is entered as a sequence of strokes on different keys or on a same key.

References relevant to classification in this group

This subgroup does not cover:

Interaction with virtual keyboards displayed on a touchscreen	G06F 3/04886
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G06F 3/0234

{using switches operable in different directions}

Definition statement

This subgroup covers:

Keyboards or keypads having keys that can be operated not only vertically but also laterally to actuated separate switches associated to different key codes.

References relevant to classification in this group

This subgroup does not cover:

Character input using (e.g. 2 or 4 or 8) directional cursor keys for selecting characters in cooperation with displayed information	G06F 3/0236
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G06F 3/0235

{using chord techniques ([G06F 3/0234](#) takes precedence)}

Definition statement

This subgroup covers:

Chord keyboards even if they are split in two or more parts, i.e. the predominant feature is the fact that chording is required to enter a character.

References relevant to classification in this group

This subgroup does not cover:

Character input using switches operable in different directions	G06F 3/0234
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Chord	only an almost simultaneous depression of several keys
-------	--

G06F 3/0236

{using selection techniques to select from displayed items}

References relevant to classification in this group

This subgroup does not cover:

Selecting from displayed items by using keys for other purposes than character input	G06F 3/0489
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G06F 3/0237

{using prediction or retrieval techniques}

Definition statement

This subgroup covers:

Character input using retrieval techniques from a database or dictionary based on previously inputted characters, e.g. for predicting and proposing word completion alternatives.

Covers inter alia T9, iTap and similar techniques.

References relevant to classification in this group

This subgroup does not cover:

Guess-ahead for partial word input (code gives word) in systems handling natural language data by automatic analysis or parsing (e.g. for stenotyping):	G06F 17/276
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

T9 (stands for Text on 9 keys)	a predictive text input technology for mobile phones, developed by Tegic Communications
--------------------------------	---

iTap	a predictive text technology for mobile phones, developed by Motorola
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G06F 3/0238

{Programmable keyboards (key guide holders [G06F 3/0224](#))}

Definition statement

This subgroup covers:

Any keyboard in which the function assigned to all or some of the keys can be reprogrammed, e.g. changing alphabetical keys according to language, programming dedicated function keys.

References relevant to classification in this group

This subgroup does not cover:

Key guide holders	G06F 3/0224
Virtual keyboards on a touchscreen	G06F 3/04886
Scrambling keyboard with display keys in electronically operated locks:	G07C 9/00698
Scrambling keyboard in electronically banking systems (POS,ATM):	G07F
Switches with programmable display:	H01H 9/181
Telephone set with programmable function keys:	H04M 1/2472

Informative references

Attention is drawn to the following places, which may be of interest for search:

Display on the key tops of musical instruments:	G10H
Display on the key tops in general	H01H 2219/00

G06F 3/027

for insertion of decimal point {(display of decimal point [G06F 3/1407](#); complete desk- top or hand- held calculators [G06F 15/02](#))}

References relevant to classification in this group

This subgroup does not cover:

Display of decimal point	G06F 3/1407
Complete desk- top or hand- held calculators	G06F 15/02

Special rules of classification within this group

Old technology, not used anymore.

G06F 3/03

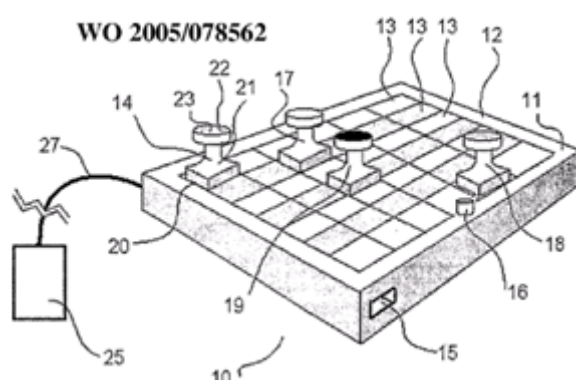
Arrangements for converting the position or the displacement of a member into a coded form

Definition statement

This subgroup covers:

This group is used only for "exotic" input devices corresponding to the wording of the definition and not fitting in any of the subgroups, for example arrangements detecting the position or the displacement of tangible user interfaces comprising RFIDs tags or bar codes interacting with a surface (such as chessboard-like surface) where the position detection technique is not covered by any of the subgroups of [G06F 3/03](#).

Example:



References relevant to classification in this group

This subgroup does not cover:

Electronic game devices per se	A63K
Coordinate identification of nuclear particle tracks	G01T 5/02
Interaction with a tangible user interface other than detecting its location or displacement	G06F 3/00
Telemetry of coordinates	G08C 21/00

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

A Tangible User Interface (TUI)	a user interface in which a person interacts with digital information through a physical environment, i.e. by manipulating physical objects (e.g. in the same way as moving pieces of a game on a tablet), often using RFID or NFC
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Synonyms and Keywords

In patent documents the following abbreviations are often used:

TUI	Tangible User Interface
RFID	Radio-Frequency IDentification
NFC	Near Field Communication

G06F 3/0304

{Detection arrangements using opto-electronic means (constructional details of pointing devices not related to the detection arrangement using opto-electronic means [G06F 3/033](#) and subgroups; optical digitisers [G06F 3/042](#))}

Definition statement

This subgroup covers:

When there is a doubt whether the subject matter belongs to [G06F 3/0304](#) and below or to [G06F 3/042](#) and below, the rule of thumb is: if the moving part is the sensor then it belongs to [G06F 3/0304](#) and below, if the observed target (e.g. finger) is moving then it belongs to [G06F 3/042](#) and below.

References relevant to classification in this group

This subgroup does not cover:

Measuring arrangements characterised by the use of optical means	G01B 11/00
Optical encoders	G01D 5/34
Position fixing using optical waves	G01S 5/16 , G01S 17/00
Prospecting or detecting by optical means	G01V 8/00
Constructional details of pointing devices not related to the detection arrangement using opto-electronic means	G06F 3/033

Systems where the position detection is based on the raster scan of a cathode-ray tube (CRT) with a light pen	G06F 3/037
Digitisers using opto-electronic means	G06F 3/042
Static switches using electro-optical elements in general	H03K 17/78
Optical switches	H03K 17/941
Optical touch switches	H03K 17/9627

G06F 3/0317

{in co-operation with a patterned surface, e.g. absolute position or relative movement detection for an optical mouse or pen positioned with respect to a coded surface}

Definition statement

This subgroup covers:

Tracking relative movement in co-operation with a regularly or irregularly patterned surface, e.g. arrangements for detecting relative movement of an optical mouse with respect to a generic surface optically detected as irregularly patterned (table, desk top, ordinary mouse pad) or with respect to a surface (e.g. mouse pad) encoded with an optically detectable regular pattern.

Arrangements for detecting absolute position of a member with respect to a regularly patterned surface, e.g. pen optically detecting position-indicative tags printed on a paper sheet.

G06F 3/033

Pointing devices displaced or positioned by the user, e.g. mice, trackballs, pens or joysticks; Accessories therefor {(constructional details of joysticks [G05G 9/047](#); arrangement for interfacing a joystick to a computer [G06F 3/038](#))}

References relevant to classification in this group

This subgroup does not cover:

Details of optical sensing in input devices	G06F 3/0304
Arrangement for interfacing a joystick to a computer	G06F 3/038
Constructional details of joysticks	G05G 9/047

Special rules of classification within this group

For finger worn pointing devices covered by this group and its subgroups add the Indexing Code [G06F 2203/0331](#).

Synonyms and Keywords

In patent documents the following abbreviations are often used:

RSI	Repetitive Stress Injury
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G06F 3/0338

with detection of limited linear or angular displacement of an operating part of the device from a neutral position, e.g. isotonic or isometric joysticks

References relevant to classification in this group

This subgroup does not cover:

Joysticks with a pivotable rigid stick	G05G 9/047
Integration of a mini joystick in a portable computer	G06F 1/169
Integration of a mini joystick in a keyboard	G06F 3/0213
Sliders, in which the moving part moves in a plane	G06F 3/03548
Details of the interface with a computer	G06F 3/038
Switches with generally flat operating part depressible at different locations	H01H 25/041

G06F 3/0346

with detection of the device orientation or free movement in a 3D space, e.g. 3D mice, 6-DOF [six degrees of freedom] pointers using gyroscopes, accelerometers or tilt-sensors

Definition statement

This subgroup covers:

Devices sensing their own position or orientation in a three dimensional space, allowing thereby the user to input up to 6 coordinates (position + orientation) by moving the device. Covers inter alia 3D mice.

Relationship between large subject matter areas

Remote control based on movements [G08C](#).

References relevant to classification in this group

This subgroup does not cover:

3D input gestures	G06F 3/017
Input devices using opto-electronic sensing	G06F 3/0304

G06F 3/03542

{Light pens for emitting or receiving light}

Definition statement

This subgroup covers:

Pens detecting the presence of light on one point (such as a CRT scanning beam).

Light emitting pens positioned in contact or proximity of the pointed position.

References relevant to classification in this group

This subgroup does not cover:

Pens comprising an optical sensor for 1 or 2 dimensional position detection	G06F 3/0304
Light emitting pointers per se used for marking with a light spot the pointed position from a distance	G06F 3/0346

G06F 3/03543

{Mice or pucks ([G06F 3/03541](#) takes precedence)}

References relevant to classification in this group

This subgroup does not cover:

Mouse/trackball convertible-type devices, in which the same ball is used to track the 2-dimensional relative movement	G06F 3/03541
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Special rules of classification within this group

Specific Indexing Codes [G06F 2203/0332](#) to [G06F 2203/0337](#) are associated to this group for some constructional details.

G06F 3/03545

{Pens or stylus}

Definition statement

This subgroup covers:

Pens other than optically sensing pens or light pens (e.g. for use in combination with a digitiser). Constructional details of pens in general irrespectively of the interaction technology.

Relationship between large subject matter areas

Pens used for handwriting recognition: [G06K 9/222](#), [G06K 9/24](#).

References relevant to classification in this group

This subgroup does not cover:

Details of optically sensing pens	G06F 3/0317
Light pens	G06F 3/03542

G06F 3/03547

{Touch pads, in which fingers can move on a surface}

Definition statement

This subgroup covers:

Touch surface for sensing the relative motion of a finger over the surface.

References relevant to classification in this group

This subgroup does not cover:

Digitisers	G06F 3/041
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Special rules of classification within this group

Specific Indexing Codes [G06F 2203/0338](#) and [G06F 2203/0339](#) are associated to this group for some constructional details.

G06F 3/03549

{Trackballs ([G06F 3/03541](#) takes precedence)}

References relevant to classification in this group

This subgroup does not cover:

Mouse/trackball convertible-type devices, in which the same ball is used to track the 2-dimensional relative movement	G06F 3/03541
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G06F 3/0362

with detection of 1D translations or rotations of an operating part of the device, e.g. scroll wheels, sliders, knobs, rollers or belts

References relevant to classification in this group

This subgroup does not cover:

User controls for vehicle, e.g. dashboard knobs	B60K 37/06
Incremental encoders	G01D 5/244 , G01D 5/347
Sliding switches	H01H 15/00
Rotary encoding wheels - "thumb-wheel switches"	H01H 19/001

G06F 3/038

Control and interface arrangements therefor, e.g. drivers or device-embedded control circuitry

References relevant to classification in this group

This subgroup does not cover:

Control circuits or drivers for touchscreens or digitisers	G06F 3/0416
Graphical user interfaces (GUI) in general	G06F 3/048
Pointing device drivers modified to control cursor appearance or behaviour taking into account the presence of displayed objects	G06F 3/04812

G06F 3/0386

{for light pen}

Definition statement

This subgroup covers:

Tracking a projected light spot generated by a light pen or a "laser pointer" indicating a position on a display surface, drivers for light pen systems.

References relevant to classification in this group

This subgroup does not cover:

Light pen using the raster scan of a CRT	G06F 3/037
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Light emitting pens positioned in contact or proximity of the pointed position	G06F 3/03542
Light emitting pointers per se used for marking with a light spot the pointed position from a distance	G06F 3/0346

G06F 3/039

Accessories therefor, e.g. mouse pads (furniture aspects [A47B 21/00](#))

References relevant to classification in this group

This subgroup does not cover:

Platforms for supporting wrists as table extension	A47B 21/0371
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Furniture aspects	A47B 21/00
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G06F 3/041

Digitisers, e.g. for touch screens or touch pads, characterized by the transducing means

Definition statement

This subgroup covers:

Position sensing of movable objects such as fingers or pens in contact with a surface or within a relative small distance to this surface (hovering).

This group has been created with the introduction of IPC 8 (2006); before that date, the subject matter of this group and its subgroups was classified in the class range [G06K 11/06](#) - **G06K11/16** (up to IPC 7).

References relevant to classification in this group

This subgroup does not cover:

True 3D computer input devices with a freely movable member	G06F 3/0346
3D input gestures	G06F 3/017

Informative references

Attention is drawn to the following places, which may be of interest for search:

Constructional details of touchpads	G06F 3/03547
Integration of touchpad in a portable computer (laptop, PDA)	G06F 1/169
Integration of touchpad in a keyboard	G06F 3/0213
Touchscreens integrated in a portable computer	G06F 1/1643 , G06F 1/1692

Special rules of classification within this group

In this area, Indexing Codes [G06F 2203/04101](#) to [G06F 2203/04112](#) dealing with details which may be related to different sensing technologies are used in parallel to the classification scheme.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Surface	either as a physical surface or as a virtual one, such as a virtual interaction plane floating in the air
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G06F 3/0412

{Integrated displays and digitisers}

Definition statement

This subgroup covers:

Combination of displays with digitisers by sharing at least one constitutive part such as common lines for LCD control and position sensing or a common substrate.

References relevant to classification in this group

This subgroup does not cover:

Constructional details of LCDs	G02F 1/13
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Special rules of classification within this group

The sensing technology used should be also classified in the other relevant subgroups of [G06F 3/041](#).

The constructional detail of the LCDs in general are classified in [G02F 1/13](#), in particular when they also incorporate an input device [G02F 1/133308](#) is used, but [G06F 3/0412](#) takes precedence for the touch application.

G06F 3/0414

{using force sensing means}

Definition statement

This subgroup covers:

Touch position determined by the analysis of the signals provided by pressure/force sensors.

Relationship between large subject matter areas

Measuring force or stress in general: [G01L 1/00](#).

References relevant to classification in this group

This subgroup does not cover:

Tactile force sensors	G01L 5/226
Force resistance touch switches	H03K 17/9625
Piezoelectric touch switches	H03K 17/964

Special rules of classification within this group

Devices using sensors whose sole purpose is measuring the pressure/force exerted on the touch surface without providing the touch position from the signals issued from these sensors should not be classified here but in the group relevant for the position sensing technology together with the Indexing Code [G06F 2203/04105](#).

Detection of pressure applied on the touch surface using additional pressure sensitive elements participating to the position sensing process (for example material having pressure sensitive dielectric or resistive properties) or using intrinsic pressure sensitive properties of the position sensing part (for example change of capacitance due to the relative motion of electrodes) but not determining the position from the pressure value should not be classified here but in the group relevant for the position sensing technology.

G06F 3/0416

{Control and interface arrangements for touch screen}

References relevant to classification in this group

This subgroup does not cover:

Touch interaction with a GUI	G06F 3/0488
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Special rules of classification within this group

The group is not complete, see [G06F 3/0488](#).

G06F 3/042

by opto-electronic means {(pens detecting optically their absolute position with respect to a coded surface [G06F 3/0317](#))}

Relationship between large subject matter areas

Optical scanners: [G06K 7/10544](#).

References relevant to classification in this group

This subgroup does not cover:

Measuring arrangements characterised by the use of optical means	G01B 11/00
Optical encoders	G01D 5/34
Position fixing using optical waves:	G01S 5/16 , G01S 17/00
Prospecting or detecting by optical means	G01V 8/00
Systems where the position detection is based on the screen scanning with a light pen	G06F 3/0386 , G06F 3/037
Pens detecting optically their absolute position with respect to a coded surface	G06F 3/0317
Static switches using electro-optical elements in general	H03K 17/78
Optical switches	H03K 17/941
Optical touch switches	H03K 17/9627

Special rules of classification within this group

When there is a doubt whether the subject matter belongs to [G06F 3/0304](#) and below or to [G06F 3/042](#) and below, the rule of thumb is: if the moving part is the sensor then it belongs to [G06F 3/0304](#) and below, if the observed

target (e.g. finger) is moving then it belongs to [G06F 3/042](#) and below. In any case, the subclasses [G06F 3/042](#) and below are used only in the context of interaction with a surface as defined in [G06F 3/041](#) or in close proximity of this surface; they are not used in the context of a true 3D interactive environment.

Synonyms and Keywords

In patent documents the following abbreviations are often used:

FTIR	Frustrated Total Internal Reflection
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G06F 3/0421

{by interrupting or reflecting a light beam, e.g. optical touch-screen}

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Beam	a narrow beam emitted in a given direction, not as a bright band of light or as an omnidirectional lightening; in the context of beams propagating from one side towards receivers on the opposite side in a grid like arrangement, the beam may have a triangular (or conical) shape with a slightly broader opening angle in order to be sensed by several receivers on the opposite side but not covering the whole array of receivers.
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G06F 3/0423

{using sweeping light beams, e.g. using rotating or vibrating mirror}

References relevant to classification in this group

This subgroup does not cover:

Details of moving scanning beam in optical scanners	G06K 7/10603
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G06F 3/043

using propagating acoustic waves

Definition statement

This subgroup covers:

Also documents where the acoustic wave is produced by knocking or rubbing the movable member (finger or pen) on the touch surface without any other vibration generator.

References relevant to classification in this group

This subgroup does not cover:

Infra/ultrasonic mechanical vibration generators	B06B 1/00
Manufacture of resonators or networks using SAW	H03H 3/08

Synonyms and Keywords

In patent documents the following abbreviations are often used:

SAW	Surface Acoustic Waves
-----	------------------------

G06F 3/0433

{in which the acoustic waves are either generated by a movable member and propagated within a surface layer or propagated within a surface layer and captured by a movable member}

Definition statement

This subgroup covers:

Position detection using pens able either to emit acoustic waves using a dedicated wave generator (e.g. piezo-electric or mechanical vibrators, ultrasound generators or sparks) or to sense the propagating waves arriving through the surface.

References relevant to classification in this group

This subgroup does not cover:

Documents where the movable member (finger or pen) generates the waves but has no acoustic source	G06F 3/043
Piezo-electric vibrators	H01L 41/09

G06F 3/0436

{in which generating transducers and detecting transducers are attached to a single acoustic waves transmission substrate}

Definition statement

This subgroup covers:

Passive movable member (finger or pen) disturbing the propagating waves within the substrate.

G06F 3/044

by capacitive means

References relevant to classification in this group

This subgroup does not cover:

Means for converting the output of a sensing member to another variable by varying capacitance	G01D 5/24
Capacitive proximity switches	H03K 17/955
Capacitive touch switches	H03K 17/962

G06F 3/045

using resistive elements, e.g. single continuous surface or two parallel surfaces put in contact

References relevant to classification in this group

This subgroup does not cover:

Resistive potentiometers	G01D 5/165
Resistive touch switches	H03K 17/9645

G06F 3/046

by electromagnetic means

References relevant to classification in this group

This subgroup does not cover:

Means for converting the output of a sensing member to another variable by varying inductance	G01D 5/20
Electromagnetic proximity switch	H03K 17/95

G06F 3/047

using sets of wires, e.g. crossed wires

Definition statement

This subgroup covers:

Digitisers having a grid of crossing wires brought into contact when pressure is exerted on the interaction surface. The contact may be a direct contact or through a pressure sensitive switch making a connection between the wires. It includes arrays of switches integrated in a display where a galvanic contact is established between rows and columns when the user presses the display surface.

References relevant to classification in this group

This subgroup does not cover:

Sets of "wires" (e.g. electrodes) for sensing the position but in a more complex configuration using either electromagnetic/electrostatic field (without contact) or resistive measurement	G06F 3/044 - G06F 3/046
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Special rules of classification within this group

When wires or switches are integrated in a display, [G06F 3/0412](#) should also be used.

Notes

1. This group covers subject matter where the focus is placed on the way the user can interact with the displayed data. The mere presence of a standard GUI in the context of the disclosure of a specific software application or a specific device capable of processing data related to its specific function, should be in general classified in the appropriate subclasses related to those software applications or specific devices.

2. In this group, multi-aspect classification is applied, so that subject matter characterised by aspects covered by more than one of its groups, which is considered to represent information of interest for search, should be classified in each of those groups.

G06F 3/048

Interaction techniques based on graphical user interfaces [GUI]

Definition statement

This subgroup covers:

Interaction techniques for GUIs per se, or their application to a computer (system) in general.

Relationship between large subject matter areas

Control or regulating in general: [G05B](#).

Display control circuits: [G09G](#).

Pictorial communication, e.g. television: [H04N](#).

Application of (standard features of) GUIs to a particular technical field, see the corresponding field.

References relevant to classification in this group

This subgroup does not cover:

Input/output arrangements of navigation systems	G01C 21/36
Program-control in industrial systems	G05B 19/00
Hardware interface between computer and display	G06F 3/14
User interface programs, e.g. command shells, help systems, UIMS	G06F 9/4443
Drawing of charts or graphs	G06T 11/206
Editing figures and text	G06T 11/60
Control arrangements or circuits for visual displays	G09G 5/00
E.g. for display of multiple viewports	G09G 5/14
End user interface for interactive television or video on demand	H04N 21/47
Interaction with a remote controller on a TV display	H04N 5/44582 , H04N 5/4403

Synonyms and Keywords

In patent documents the following abbreviations are often used:

GUI	Graphical User Interface
-----	--------------------------

G06F 3/0481

based on specific properties of the displayed interaction object or a metaphor-based environment, e.g. interaction with desktop elements like windows or icons, or assisted by a cursor's changing behaviour or appearance

Special rules of classification within this group

In the [G06F 3/048](#) group and its subgroups, multi-aspect classification is applied. If an interaction technique is characterized by the fact that it is designed around a metaphor or interaction object, then it should be classified in [G06F 3/0481](#) or in the related subgroups

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Cursor (also called (mouse) pointer)	an indicator used to show the position on a computer display that will respond to input from a text input or pointing device
--------------------------------------	--

G06F 3/04812

{interaction techniques based on cursor appearance or behaviour being affected by the presence of displayed objects, e.g. visual feedback during interaction with elements of a graphical user interface through change in cursor appearance, constraint movement or attraction/repulsion with respect to a displayed object (interaction techniques based on cursor behaviour involving tactile or force feedback [G06F 3/016](#))}

References relevant to classification in this group

This subgroup does not cover:

Interaction techniques based on cursor behaviour involving tactile or force feedback	G06F 3/016
Interaction techniques for the selection of a displayed object	G06F 3/04842

G06F 3/04815

{Interaction with three-dimensional environments, e.g. control of viewpoint to navigate in the environment}

References relevant to classification in this subgroup

This subgroup does not cover:

Navigational instruments, e.g. visual route guidance using 3D or perspective road maps (including 3D objects and buildings)	G01C 21/3635 , G01C 21/3638
Navigation within 3D models or images (Walk- or flight-through a virtual museum, a virtual building, a virtual landscape etc.)	G06T 19/003

Informative references

Attention is drawn to the following places, which may be of interest for search:

Video games	A63F 13/00
3D image rendering in general	G06T 15/00
Perspective computation in 3D image rendering	G06T 15/20

G06F 3/04817

{using icons (graphical programming languages using iconic symbols [G06F 8/34](#))}

Definition statement

This subgroup covers:

Documents describing icons having a specific (or unconventional) design or specific properties.

References relevant to classification in this group

This subgroup does not cover:

Graphical programming languages using iconic symbols	G06F 8/34
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G06F 3/0482

interaction with lists of selectable items, e.g. menus

References relevant to classification in this group

This subgroup does not cover:

Operating a cordless telephone by selecting telephonic functions from a plurality of displayed items, e.g. menus, icons	H04M 1/72583
Menu-type displays in TV receivers	H04N 5/44543

G06F 3/0483

interaction with page-structured environments, e.g. book metaphor

Definition statement

This subgroup covers:

Also documents which relate to tabs.

Interaction techniques of e-books when they are heavily book-inspired.

References relevant to classification in this group

This subgroup does not cover:

Electronic books, also known as e-books	G06F 15/02 , G06F 15/0283
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G06F 3/0484

for the control of specific functions or operations, e.g. selecting or manipulating an object or an image, setting a parameter value or selecting a range

Special rules of classification within this group

In the [G06F 3/048](#) group and its subgroups, multi-aspect classification is applied. If an interaction technique is characterized by the fact that it is designed to control a specific function or operation, then it should be classified in [G06F 3/0484](#) or in the related subgroups

G06F 3/04842

{Selection of a displayed object ([G06F 3/0482](#) takes precedence)}

Definition statement

This subgroup covers:

GUI interaction techniques specifically designed for selecting a displayed object , e.g. window, icon

Special rules of classification within this subclass/group

This class is actually for selection by a pointing device (in the sense of [G06F 3/03](#) and subgroups) such as mouse, a joystick, a digitiser, etc...

There are some older documents relating to selection by keyboard classified here. However, all new documents related to the latter are now classified in [G06F 3/0489](#).

Every time a set of displayed of objects can be consider as structured as a "list of selectable items", the interaction technique for selecting an item should be classified in [G06F 3/0482](#).

G06F 3/04845

{for image manipulation, e.g. dragging, rotation}

Definition statement

This subgroup covers:

Covers image manipulation, e.g. dragging or rotation of the whole image, resizing of objects, changing their colour etc.

References relevant to classification in this group

This subgroup does not cover:

Image data processing or generation, in general	G06T
Editing figures and text; combining figures or text	G06T 11/60

G06F 3/0485

Scrolling or panning

Definition statement

This subgroup covers:

Also documents dealing with panning control.

References relevant to classification in this group

This subgroup does not cover:

Interaction with scrollbars	G06F 3/04855
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Scrolling	"dragging" in some applications, i.e. depicting a user gesture which is not causing a motion of a previously selected object, but rather a motion of a reference within a given context. Such scrolling interactions are covered by this group
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G06F 3/0486

Drag-and-drop

Definition statement

This subgroup covers:

Drag and drop operations comprise moving by the user a previously selected object, and finally releasing said object.

References relevant to classification in this group

This subgroup does not cover:

Interaction techniques to control scrolling	G06F 3/0485
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Dragging	"scrolling", i.e. depicting a user gesture which is not causing a motion of a previously selected object, but rather a motion of a reference within a given context. Such scrolling interactions are not covered by this group
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G06F 3/0487

using specific features provided by the input device, e.g. functions controlled by the rotation of a mouse with dual sensing arrangements, or of the nature of the input device, e.g. tap gestures based on pressure sensed by a digitiser

Special rules of classification within this group

In the [G06F 3/048](#) group and its subgroups, multi-aspect classification is applied. If an interaction technique is characterized by the fact that it is designed to take into account specific properties of the input device, then it should be classified in [G06F 3/0487](#) or in the related subgroups

G06F 3/0488

using a touch-screen or digitiser, e.g. input of commands through traced gestures

Relationship between large subject matter areas

Details of input/output arrangements of navigation systems including use of a touch screen and gestures: [G01C 21/3664](#).

References relevant to classification in this group

This subgroup does not cover:

Constructional details of digitisers	G06F 3/041
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G06F 3/04883

{for entering handwritten data, e.g. gestures, text}

References relevant to classification in this group

This subgroup does not cover:

3D input gestures	G06F 3/017
Signature recognition	G06K 9/00154
Digital ink recognition	G06K 9/00402
Handwriting per se	G06K 9/222

G06F 3/04886

{by partitioning the screen or tablet into independently controllable areas, e.g. virtual keyboards, menus ([G06F 3/04883](#) takes precedence)}

Definition statement

This subgroup covers:

Covers virtual keyboards displayed on a touchscreen or as a template on a tablet.

References relevant to classification in this group

This subgroup does not cover:

Arrangements for projecting a virtual keyboard in a portable computers	G06F 1/1673
Programmable (hardware) keyboards	G06F 3/0238
Entering handwritten data, e.g. gestures, text	G06F 3/04883

Informative references

Attention is drawn to the following places, which may be of interest for search:

Character input methods like chording, prediction or disambiguation used on a keyboard:	G06F 3/0233
Guess-ahead for partial word input (code gives word) in systems handling natural language data by automatic analysis or parsing (e.g. for stenotyping)	G06F 17/276

G06F 3/0489

using dedicated keyboard keys or combinations thereof

Relationship between large subject matter areas

Coin-freed or like apparatus: [G07F](#).

Arrangements or circuits for control of visual displays: [G09G](#).

References relevant to classification in this group

This subgroup does not cover:

Selecting from displayed items by using keys for character input	G06F 3/0236
Automatic teller machines (ATM)	G07F 19/20

Adjusting display parameters	G09G 5/00
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G06F 3/06

Digital input from or digital output to record carriers, {e.g. RAID, emulated record carriers, networked record carriers (recording or reproducing devices per se [G11B](#); error detection, error correction, monitoring per se regarding storage systems [G06F 11/00](#); accessing or addressing within memory systems or architectures [G06F 12/00](#); information retrieval [G06F 17/30](#)}}

Definition statement

This subgroup covers:

This head-group of the [G06F 3/06](#) range mostly contains very old storage technologies like magnetic drums, punched tapes, storage on a wire etc.

Special rules of classification within this subclass/group

Normally, no new documents should be added to this group. New documents should be classified in the branches under [G06F 3/0601](#) (see the section Special rules of classification under [G06F 3/0601](#) for further indication on classification practice).

G06F 3/0601

{Dedicated interfaces to storage systems}

Definition statement

This subgroup covers:

Physical and/or logical interfaces between a host or a plurality of hosts and a storage device or a plurality of storage devices or storage system related to data/command path and data placement techniques.

Storage devices include devices with rotating magnetic and optical storage media as well as solid state devices, or non-volatile electronic storage elements.

Also covered are interfaces to an emulated rotating storage device in (flash) memory.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Recording or reproducing devices per se	G11B 3/00 - G11B 33/00
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Error detection, error correction, monitoring per se	G06F 11/00
Communication control characterised by a protocol	H04L 29/06
Accessing, addressing or allocation within memory systems	G06F 12/00
Interconnection of, or transfer of information between memories, I/O devices, CPUs	G06F 13/00
File systems; file servers	G06F 17/30067

Special rules of classification within this subclass/group

This group contains older documents (published before the year 2000) from which the majority are not reorganised in the [G06F 3/0601](#) plus range.

No new/recent documents should be classified in [G06F 3/0601](#). Each new document should receive regarding "invention information":

1. at least one class in the range [G06F 3/0602](#) - [G06F 3/0626](#) for the technical effect achieved and
2. at least one class in the range [G06F 3/0629](#) - **G06F3/0067** for the technique used and
3. at least one class in the range [G06F 3/067](#) - **G03F3/0689** for the infrastructure involved.

The classification of "additional information" is optional. CPC symbols in the range [G06F 2206/10](#) - [G06F 2206/1014](#) should be used for classifying "additional information".

The older documents should be retrieved using CPC break-out codes:

- [G06F 2003/0691](#) Buffering arrangements
- [G06F 2003/0692](#) Digital I/O from or to DASD e.g. disks
- [G06F 2003/0694](#) Emulating arrangements e.g. RAM disk
- [G06F 2003/0695](#) Formatting arrangements
- [G06F 2003/0697](#) Device management e.g. drivers, schedulers
- [G06F 2003/0698](#) Digital I/O from or to SASD e.g. tapes

Important: these codes are only for document retrieval purposes and should never be assigned to new documents.

The "additional information" for the older documents can be found by combining the above CPC code(s) with the code [G06F 3/0601](#)

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Storage system: an integrated collection of (a.) storage controllers and/or host bus adapters, (b.) storage devices such as disks, CD-ROMs, tapes, media loaders and robots, and (c.) any required control software, that provides storage services to one or more computers.

Synonyms and Keywords

host: computer, PC , PDA , smartphone, (micro)processor, CPU, terminal, client

G06F 3/0602

{specifically adapted to achieve a particular effect}

Definition statement

This subgroup covers:

This group is the hierarchical head group for the range [G06F 3/0604](#) - [G06F 3/0626](#) related to particular storage effects and is not used for classification.

G06F 3/0604

{Improving or facilitating administration, e.g. storage management}

Definition statement

This subgroup covers:

All general aspects of storage administration which do not fit in the subgroups [G06F 3/0605](#) and [G06F 3/0607](#)

G06F 3/0605

{by facilitating the interaction with a user or administrator}

Definition statement

This subgroup covers:

Facilitating administration like automating recurrent tasks, selecting and presenting management information to the system user or administrator.

G06F 3/0607

{by facilitating the process of upgrading existing storage systems}

Definition statement

This subgroup covers:

Facilitating administration in relation to modification of existing systems, improving compatibility and scalability.

G06F 3/0608

{Saving storage space on storage systems}

Definition statement

This subgroup covers:

Effects leading to the reduction of the volume of data stored and the storage space requirements e.g. storage efficiency: the ratio of storage system's effective capacity to its raw capacity.

Relationship between large subject matter areas

This group is often combined with the technique [G06F 3/0641](#): data deduplication

G06F 3/061

{Improving I/O performance}

Definition statement

This subgroup covers:

All aspects of improving the I/O performance of a storage system that do not fit in the subgroups [G06F 3/0611](#) - [G06F 3/0613](#).

G06F 3/0611

{in relation to response time}

Definition statement

This subgroup covers:

Reducing I/O operation latency time: the time between the making of an I/O request and the completion of the request's execution.

G06F 3/0613

{in relation to throughput}

Definition statement

This subgroup covers:

Increasing I/O operation throughput: the number of I/O requests satisfied in a given time e.g. expressed in I/O requests/second (IOPS)

G06F 3/0614

{Improving the reliability of storage systems}

Definition statement

This subgroup covers:

All reliability aspects which do not fit in the subgroups [G06F 3/0616](#)-[G06F 3/0619](#). Only reliability effects with a technique specific for [G06F 3/06](#) should be classified in this subgroup range.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Error detection or correction by redundancy in operation	G06F 11/14
Redundancy in hardware using active fault-masking	G06F 11/20

G06F 3/0616

{in relation to life time, e.g. increasing Mean Time Between Failures [MTBF]}

Definition statement

This subgroup covers:

Increasing the life expectancy measured in e.g. Mean Time Between Failures (MTBF)

Informative references

Attention is drawn to the following places, which may be of interest for search:

User address space allocation in block erasable memory:	G06F 12/0246
Auxiliary circuits for EPROMs:	G11C 16/06

Special rules of classification within this subclass/group

The subject covered by this group is often described in relation to non-volatile semiconductor memory (arrays), which are, as peculiar storage infrastructure, also classified in [G06F 3/0679](#) or [G06F 3/0688](#)

G06F 3/0617

{in relation to availability}

Definition statement

This subgroup covers:

Increasing availability: the amount of time the system is available during those time periods it is expected to be available, measured in e.g. hours of downtime in a year

Informative references

Attention is drawn to the following places, which may be of interest for search:

Redundancy in hardware using active fault-masking:	G06F 11/20
Redundancy in operation:	G06F 11/14

G06F 3/0619

{in relation to data integrity, e.g. data losses, bit errors}

Definition statement

This subgroup covers:

Avoiding data to be altered or lost in operation or by accident.

References relevant to classification in this subclass/group

This subgroup does not cover:

Redundancy in hardware by mirroring:	G06F 11/2056
Adding special bits or symbols to the coded information in memories:	G06F 11/1008
Backing up (Point in time copy), restoring or mirroring files or drives:	G06F 11/1446
Error detection or correction in digital recording or reproducing:	G11B 20/18

G06F 3/062

{Securing storage systems}

Definition statement

This subgroup covers:

All security aspects which do not fit in the subgroups

[G06F 3/0622](#) - [G06F 3/0625](#)

References relevant to classification in this subclass/group

This subgroup does not cover:

Protecting computer components used for data storage:	G06F 21/78
Protecting data against unauthorised access or modification:	G06F21/00N9
Arrangements for network security:	H04L 29/06551 H04L29/63

G06F 3/0622

{in relation to access}

Definition statement

This subgroup covers:

Securing storage systems by preventing unauthorised access to the storage system, e.g. with a password.

References relevant to classification in this subclass/group

This subgroup does not cover:

Protecting computer components used for data storage	G06F 21/78
Protecting data against unauthorised access or modification	G06F 21/60
Arrangements for network security	H04L 29/06551 (H04L29/63)

G06F 3/0623

{in relation to content}

Definition statement*This subgroup covers:*

Securing storage systems by protecting the data content, e.g. by scrambling the content.

References relevant to classification in this subclass/group*This subgroup does not cover:*

Protecting computer components used for data storage	G06F 21/78
Protecting data against unauthorised access or modification	G06F 21/60
Arrangements for network security	H04L 29/06551 H04L29/63

G06F 3/0625

{Power saving in storage systems}

Definition statement*This subgroup covers:*

Reducing the power consumption of a storage system: power efficiency

Power saving in storage systems with a plurality of storage devices external to the computer should be classified here.

References relevant to classification in this subclass/group*This subgroup does not cover:*

Power saving in a single storage device inside a computer	G06F1/32P6
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Informative references*Attention is drawn to the following places, which may be of interest for search:*

Power management of disk drive devices:	G06F1/32P6H
Driving, starting, stopping record carriers:	G11B 19/00

Special rules of classification within this subclass/group

This group is usually combined with the technique [G06F 3/0634](#) (configuration or reconfiguration of storage systems by changing the state or mode of one or more devices) in order to characterise the technique for the "invention information".

This group is usually combined with the infrastructure [G06F 3/0689](#) (disk arrays) or [G06F 3/067](#) (distributed storage)

G06F 3/0626

{Reducing size or complexity of storage systems}

Definition statement

This subgroup covers:

Reducing the physical size, simplifying the physical integration of storage systems

Relationship between large subject matter areas

This group is often combined with [G06F 3/0658](#) (controller construction) in order to characterise the technique for the "invention information", e.g. System On Chip (SOC) controller

G06F 3/0628

{making use of a particular technique}

Definition statement

This subgroup covers:

This group is the hierarchical head group for the range [G06F 3/0629](#) - [G06F 3/0667](#) related to particular storage techniques and is not used for classification.

G06F 3/0629

{Configuration or reconfiguration of storage systems}

Definition statement

This subgroup covers:

All configuration or reconfiguration aspects which do not fit in the subgroups.

The general management of storage system features and behaviours through the control of changes made to hardware, software, firmware and related resources throughout the life cycle of the storage system.

G06F 3/0631

{by allocating resources to storage systems}

Definition statement

This subgroup covers:

Allocating physical and/or logical storage resources, including storage elements, storage devices, appliances, virtual devices, disk volume and file resources.

Mapping aspects: conversion between two address spaces, such as the conversion between physical disk block addresses and logical disk block addresses of the virtual disks presented to operating environments by control software i.e. by using a mapping table which contains the correspondence between the two address spaces being mapped to each other.

Partitioning of storage system i.e. the creation of partitions.

References relevant to classification in this subclass/group

This subgroup does not cover:

Management of already existing partitions	G06F 3/0644
Allocation of resources in multiprogramming arrangements	G06F 9/50

Informative references

Attention is drawn to the following places, which may be of interest for search:

Addressing or allocation	G06F 12/02
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Partitioning : presentation of the usable storage capacity of a disk or array to an operating environment in the form of several virtual disks whose aggregate capacity approximates that of the underlying physical or virtual disk.

Partitioning is common in MS-DOS, Windows, and UNIX environments.

Partitioning is useful with hosts that cannot support the full capacity of a large disk or array as one device. It can also be useful administratively, for example, to create hard subdivisions of a large virtual disk.

G06F 3/0632

{by initialisation or re-initialisation of storage systems}

Definition statement

This subgroup covers:

1. The startup and initial configuration of a storage device, system, piece of software or network.
2. The process of installing or removing hardware or software components required for a system or subsystem to function.
3. Assignment of the operating parameters of a system, subsystem or device, such as designating a disk array's member disks or extents and parameters such as stripe depth, RAID model, cache allowance, etc.
4. The collection of a system's hardware and software components and operating parameters.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Program loading or initiating	G06F 9/445
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Discovery of storage devices Array configuration

1. Assignment of the disks and operating parameters for a disk array by setting parameters such as stripe depth, RAID model, cache allowance, spare disk assignments, etc.
2. the arrangement of disks and operating parameters that results from such an assignment.

G06F 3/0634

{by changing the state or mode of one or more devices}

Definition statement

This subgroup covers:

Changing the operating state or mode or parameters of one or more storage devices e.g. changing the rotational speed (measured in RPM) or powering on/off or spinning up/down one or more storage devices.

Special rules of classification within this subclass/group

This group is often assigned when there is a power saving effect mentioned
see [G06F 3/0625](#)

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Massive Array of Idle Disks (MAID) : a storage system comprising an array of disk drives that are powered down individually or in groups when not required. MAID storage systems reduce the power consumed by a storage array, at the cost of increased Mean Time To Data.

Synonyms and Keywords

MAID

G06F 3/0635

{by changing the path, e.g. traffic rerouting, path reconfiguration}

Definition statement

This subgroup covers:

Changing the configuration of a storage system by changing the interconnections in between storage system components or changing the routes over which the data flows from the host to the storage device and vice versa e.g. storage switches, storage ports, routing aspects in storage systems.

Relationship between large subject matter areas

This group is usually combined with [G06F 3/0607](#): improving administration by facilitating the process of upgrading existing storage systems.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Arrangements and networking functions for distributed storage in a network	H04L 29/08549
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Access path: the combination of adapters, addresses and routes through a switching fabric used by a computer to communicate with a storage device.

G06F 3/0637**{Permissions}****Definition statement***This subgroup covers:*

Techniques related to the right of a user or host or group of users or group of hosts to access specific parts of a storage system, e.g. zoning, locking , shared access

References relevant to classification in this subclass/group*This subgroup does not cover:*

Protecting computer components used for data storage:	G06F21/00N1D
Access control in arrangements for network security e.g. Access Control Lists (ACL):	H04L 29/06823 (H04L29/63)

Special rules of classification within this subclass/group

This group is usually combined with the effect [G06F 3/0622](#):securing storage system in relation to access

G06F 3/0638**{Organizing or formatting or addressing of data}****Definition statement***This subgroup covers:*

All general aspects of data organising or formatting or addressing that does not fit in the subgroups e.g. compression of data in general in a storage interface.

References relevant to classification in this subclass/group*This subgroup does not cover:*

Conversion of data formats	G06F 3/0661
Time compression or expansion in a recording device	G11B 20/00007
Compression per se	H03M 7/30
Image compression	G06T 9/00
Audio compression	G10L 19/00
Data compression in computer networks	H04I29/06C5
Video compression	H04N 19/00

G06F 3/064

{Management of blocks}

Definition statement

This subgroup covers:

Techniques related to the management of blocks in storage systems

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Block: the unit in which data is stored and retrieved on disk and tape devices; the atomic unit of data recognition (through a preamble and block header) and protection (through a CRC or ECC).

Block addressing: an algorithm for uniquely identifying blocks of data stored on disk or tape media by number, and then translating these numbers into physical locations on the media.

G06F 3/0641

{De-duplication techniques}

Definition statement

This subgroup covers:

Techniques related to data deduplication: the replacement of multiple copies of data - at variable levels of granularity - with references to a shared copy in order to save storage space and/or bandwidth.

References relevant to classification in this subclass/group

This subgroup does not cover:

Using de-duplication of the data stored as backup	G06F 11/1453
File systems; File servers	G06F 17/30067
Compression per se	H03M 7/30

Special rules of classification within this subclass/group

This group is usually combined with [G06F 3/0608](#): saving storage space

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Data deduplication: the replacement of multiple copies of data—at variable levels of granularity—with references to a shared copy in order to save storage space and/or bandwidth.

G06F 3/0643

{Management of files}

Definition statement

This subgroup covers:

Techniques related to the management of files in storage systems, e.g. low level file system aspects like File Allocation Tables (FAT)

References relevant to classification in this subclass/group

This subgroup does not cover:

File systems; file servers per se	G06F 17/30067
User address space allocation	G06F 12/0223
Processing unordered random access data using directory or table look-up	G06F17/30P1D
Table of contents on record carriers (VTOC)	G11B 27/327

G06F 3/0644

{Management of space entities, e.g. partitions, extents, pools}

Definition statement

This subgroup covers:

Techniques related to the management of space entities in storage systems, e.g. management of partitions, extents, pools

References relevant to classification in this subclass/group

This subgroup does not cover:

Creation of space entities (allocating resources to storage systems)	G06F 3/0631
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Informative references

Attention is drawn to the following places, which may be of interest for search:

File systems; File servers	G06F 17/30067
User address space allocation	G06F 12/0223
Arrangements and networking functions for distributed storage of data in a network	H04I29/08N9S , H04L 67/1097
Table of contents on record carriers (VTOC)	G11B 27/327

G06F 3/0646

{Horizontal data movement in storage systems, i.e. moving data in between storage devices or systems}

Definition statement

This subgroup covers:

All general aspects of horizontal moving of data between storage devices or systems which do not fit in the sub-groups.

G06F 3/0647

{Migration mechanisms}

Definition statement

This subgroup covers:

Movement of data or information between information systems, formats, or media. Migration is performed for reasons such as possible decay of storage media, obsolete hardware or software (including obsolete data formats), changing performance requirements (see tiered storage), the need for cost efficiencies etc.

References relevant to classification in this subclass/group

This subgroup does not cover:

Automatically moving less frequently accessed objects to lower levels in the hierarchy (Lifecycle management)	G06F 3/0649
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Special rules of classification within this subclass/group

HSM and Tiered storage aspect are usually combined with **G06F3/06A6I4H** (hierarchical storage) in order to characterise the infrastructure.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Tiered storage : storage that is physically partitioned into multiple distinct classes based on price, performance or other attributes. Data may be dynamically moved among classes in a tiered storage implementation based on access activity or other considerations.

Hierarchical Storage Management (HSM) : The automated migration of data objects among storage devices, usually based on inactivity. Hierarchical storage management is based on the concept of a cost-performance storage hierarchy. By accepting lower access performance (higher access times), one can store objects less expensively.

G06F 3/0649

{Lifecycle management}

Definition statement

This subgroup covers:

Data Lifecycle Management (DLM) the policies, processes, practices, services and tools used to align the business value of data with the most appropriate and cost-effective storage infrastructure from the time data is created through its final disposition. Data is aligned with business requirements through management policies and service levels associated with performance, availability, recoverability, cost, etc. DLM is a subset of Information Lifecycle Management (ILM).

By automatically moving less frequently accessed objects to lower levels in the hierarchy, higher cost storage is freed for more active objects, and a better overall cost to performance ratio is achieved

References relevant to classification in this subclass/group

This subgroup does not cover:

Details of archiving in file system administration	G06F 17/30073
Details of hierarchical storage management (HSM) systems	G06F 17/30221

Informative references

Attention is drawn to the following places, which may be of interest for search:

File systems; File servers	G06F 17/30067
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Synonyms and Keywords

Retention policy, retention time

G06F 3/065

{Replication mechanisms}

Definition statement

This subgroup covers:

Replication is the technique of sharing information so as to ensure consistency between redundant resources, such as software or hardware components, to improve reliability, fault-tolerance, or accessibility.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Redundancy in hardware by mirroring: [G06F 11/2056](#) Backing up (Point in time copy), restoring or mirroring files or drives: [G06F 11/1402](#)

Redundancy in hardware by mirroring	G06F 11/2056
Backing up (Point in time copy), restoring or mirroring files or drives	G06F 11/1402

Special rules of classification within this subclass/group

This group is usually combined with [G06F 3/0614](#) (improving the reliability of storage systems) and subrange in order to characterise the effect achieved by the replication mechanism.

Synonyms and Keywords

Remote copy, mirroring, snapshot

G06F 3/0652

{Erasing, e.g. deleting, data cleaning, moving of data to a wastebasket}

Definition statement

This subgroup covers:

Erasing of data in a storage systems including secure erasure.

References relevant to classification in this subclass/group

This subgroup does not cover:

Secure erasure including encryption techniques	G06F 21/78
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Informative references

Attention is drawn to the following places, which may be of interest for search:

File systems; File servers	G06F 17/30067
Clearing memory, e.g. to prevent the data from being stolen	G06F 2221/2143
Cleaning, erase control related to flash memory management	G06F 2212/7205
Delete operations in file systems	G06F 17/30117

Special rules of classification within this subclass/group

This group is often combined with [G06F 3/0623](#) (securing storage systems in relation to content) in order to characterise the effect achieved by the invention

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Data shredding: the technique of deleting data that is intended to make the data unrecoverable. One such process consists of repeated overwrites of data on disk. Data shredding is not generally held to make data completely unrecoverable in the face of modern forensic techniques—that requires shredding of the disks themselves

G06F 3/0653

{Monitoring storage devices or systems}

Definition statement

This subgroup covers:

Monitoring aspects related to storage interfaces: extra functionality for observing properties of a running storage device or storage system in its normal operating conditions without inputting test data.

References relevant to classification in this subclass/group

This subgroup does not cover:

Monitoring per se of computing systems	G06F 11/34
Network monitoring	H04L 12/2602
Monitoring testing in wireless networks	H04W 24/00
Monitoring network traffic for security	H04L 29/06884

Intrusion detection	G06F 21/566
Monitoring of control systems	G05B 23/02
Power management	G06F 1/3203
Thermal management in cooling means	G06F 1/206
Verification or detection of system hardware configuration:	G06F 11/2002
Monitoring for error detection	G06F 11/0751
Monitoring, i.e. supervising the progress of recording or reproducing	G11B 27/36

G06F 3/0655

{Vertical data movement, i.e. input-output transfer; data movement between one or more hosts and one or more storage devices}

Definition statement

This subgroup covers:

All general aspects of vertical moving of data between one or more host and one or more storage devices or systems which do not fit in the sub-groups [G06F 3/0656](#) - [G06F 3/0661](#), i.e. general I/O transfer

G06F 3/0656

{Data buffering arrangements}

Definition statement

This subgroup covers:

Arrangements using one or more buffers whereby a buffer is a memory device or programming construct, used to hold data momentarily as it moves along an I/O path or between software components.

Typically, a solid state memory device is used as a buffer. However, any storage device with faster access properties in relation to the storage device it is buffering can be used, e.g. a disk drive can act as a buffer for a tape device.

References relevant to classification in this subclass/group

This subgroup does not cover:

Caches for peripheral storage systems, e.g. disk caches	G06F 12/0866
Changing the speed of data flow, e.g. FIFO buffers per se	G06F 5/06

Partitioned buffers	G06F 5/065
Detection or prevention of read or write errors by using a data buffer	G11B 19/044

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Buffer: A region of a physical memory storage used to temporarily hold data while it is being moved from one place to another. It often adjusts timing by implementing a queue algorithm in memory, simultaneously writing data into the queue at one rate and reading it at another rate.

Synonyms and Keywords

In patent documents the following expressions/words "FIFO" and "queue" are often used as synonyms.

G06F 3/0658

{Controller construction arrangements}

Definition statement

This subgroup covers:

Constructional details of the storage interface not elsewhere provided for.

Physical connecting arrangements not elsewhere provided for.

Hardware arrangements of storage interface components like processors, bridges, offload engines, state machines

References relevant to classification in this subclass/group

This subgroup does not cover:

Disposition of constructional parts in recording / reproducing devices	G11B 33/12
Electrical connectors	H01R 13/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Information transfer on a bus, bus structures	G06F 13/40
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G06F 3/0659

{Command handling arrangements, e.g. command buffers, queues, command scheduling}

Definition statement

This subgroup covers:

Techniques related to command decoding and execution and command transformation and routing including command buffering, command queuing, command scheduling

References relevant to classification in this subclass/group

This subgroup does not cover:

Data buffering	G06F 3/0656
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

I/O scheduling: term used to describe the method computer operating systems decide the order in which block I/O operations will be submitted to storage volumes.

Synonyms and Keywords

I/O scheduling, disk scheduling

G06F 3/0661

{Format or protocol conversion arrangements}

Definition statement

This subgroup covers:

Techniques related to the conversion of recording formats, e.g. conversion from Count Key Data (CKD) format from a mainframe to Fixed Block Architecture (FBA) format of an open systems computer.

Techniques related to the conversion of storage protocols; bridging hardware e.g. conversion from Small Computer System Interface (SCSI) protocol to an Advanced Technology Attachment (ATA) protocol.

Reference document: US2010251009

References relevant to classification in this subclass/group

This subgroup does not cover:

Coupling between buses in general using bus bridges	G06F 13/4027
Information transfer using universal interface adapter:	G06F 13/382

G06F 3/0662

{Virtualisation aspects}

Definition statement

This subgroup covers:

All virtualisation aspects which do not fit in the subgroups.

Storage virtualisation refers to:

1. The act of abstracting, hiding, or isolating the internal functions of a storage (sub)system or service from applications, host computers, or general network resources, for the purpose of enabling application and network-independent management of storage or data.
2. The application of virtualization to storage services or devices for the purpose of aggregating functions or devices, hiding complexity, or adding new capabilities to lower level storage resources.

G06F 3/0664

{at device level, e.g. emulation of a storage device or system}

Definition statement

This subgroup covers:

A device presented to an operating environment by control software or by a volume manager. From an application standpoint, a virtual device is equivalent to a physical one. In some implementations, virtual devices may differ from physical ones at the operating system level, e.g., booting from a host based disk array may not be possible.

Storage device emulation, e.g. disk emulation

Storage (sub)system emulation, e. g. Virtual Tape System

Also: port virtualisation on a storage network switch, storage interface virtualisation.

References relevant to classification in this subclass/group

This subgroup does not cover:

Program control for peripheral devices where the program performs an input/output emulation function	G06F 13/105
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Virtual disk: a set of disk blocks presented to an operating environment as a range of consecutively numbered logical blocks with disk-like storage and I/O semantics.

Virtual tape: a virtual device with the characteristics of a tape.

G06F 3/0665

{at area level, e.g. provisioning of virtual or logical volumes}

Definition statement

This subgroup covers:

Storage area virtualisation: the act of applying virtualisation to one or more area based (storage) services for the purpose of providing a new aggregated, higher level—e.g., richer, simpler, more secure—storage area service to clients.

Thin provisioning Dynamic allocation of logical volumes.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Thin provisioning (also: dynamic provisioning): a technology that allocates the physical capacity of a volume or file system as applications write data, rather than preallocating all the physical capacity at the time of provisioning.

G06F 3/0667

{at data level, e.g. file, record or object virtualisation}

Definition statement

This subgroup covers:

Object virtualization:

1. the use of virtualisation to present several underlying objects as one single composite object.
2. the use of virtualisation to present an integrated object interface when object data and metadata are managed separately in the storage system

Informative references

Attention is drawn to the following places, which may be of interest for search:

File systems; File servers:	G06F 17/30067
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File systems; File servers: [G06F 17/30067](#)

G06F 3/0668

{adopting a particular infrastructure}

Definition statement

This subgroup covers:

This group is not used for classification.

Special rules of classification within this subclass/group

In this subrange, the physical storage infrastructure should be classified and not the virtualised infrastructure if present. If the virtualised storage infrastructure is important, this should be classified in [G06F 3/0664](#).

G06F 3/067

{Distributed or networked storage systems, e.g. storage area networks [SAN], network attached storage [NAS]}

Definition statement

This subgroup covers:

Architecture comprising multiple storage systems interconnected by a network allowing access from multiple hosts with emphasis on storage related aspects.

References relevant to classification in this subclass/group

This subgroup does not cover:

Network related aspects of SANs, NASes	H04L 29/08549 H04L 67/1097
Distributed file systems implemented using NAS architecture	G06F 17/30197

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Depicted below, an exemplary connection of storage device to a host through a network



G06F 3/0671

{In-line storage system}

Definition statement

This subgroup covers:

Architecture with a direct host to storage system connection attachment.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Depicted below, an exemplary connection of storage device(s) to a host through a direct connection



G06F 3/0673

{Single storage device}

Definition statement

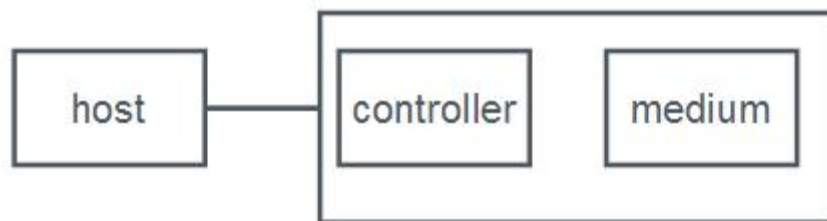
This subgroup covers:

The storage system comprising a single controller controlling one or more storage media, e.g. disks.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Depicted below, an exemplary architecture for a single storage device



G06F 3/0674

{Disk device}

Definition statement

This subgroup covers:

The storage device being a spinning disk drive: a non-volatile, randomly addressable, data storage device.

G06F 3/0676

{Magnetic disk device}

Definition statement

This subgroup covers:

The storage device being a magnetic disk drive e.g. HDD, DASD .

G06F 3/0677

{Optical disk device, e.g. CD-ROM, DVD}

Definition statement

This subgroup covers:

An optical disk drive e.g. CDROM, DVD, WORM optical disk.

G06F 3/0679

{Non-volatile semiconductor memory device, e.g. flash memory, one time programmable memory [OTP]}

Definition statement

This subgroup covers:

A semiconductor storage device e.g. SDD (solid state drive) , flash memory, one time programmable memory (OTP).

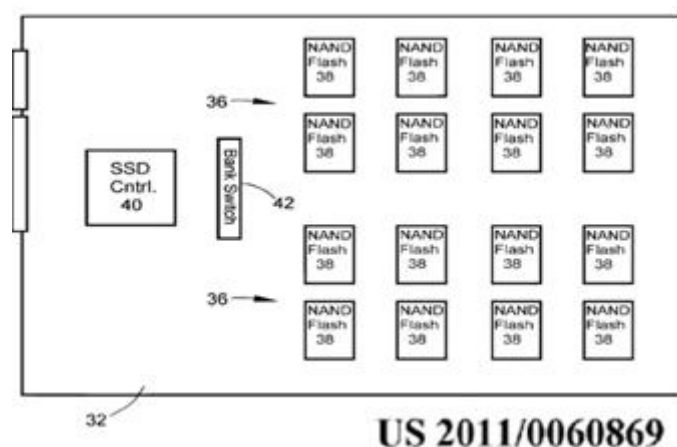
Informative references

Attention is drawn to the following places, which may be of interest for search:

User address space allocation in block erasable memory:	G06F 12/0246
Auxiliary circuits for EPROMs:	G11C 16/06

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:



G06F 3/068

{Hybrid storage device}

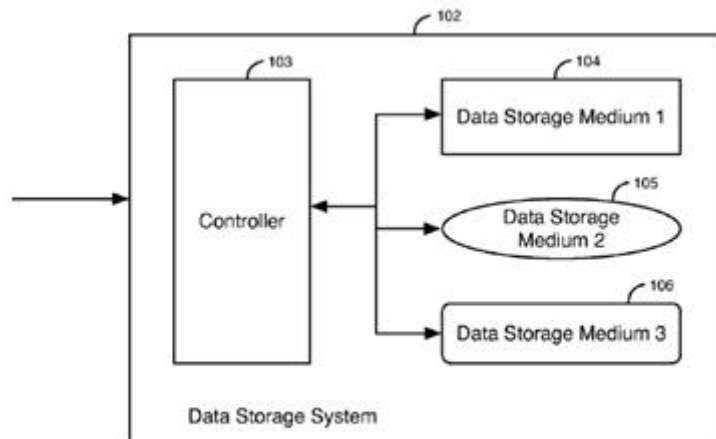
Definition statement

This subgroup covers:

Storage device comprising a controller and multiple storage medium types e.g. magnetic and semiconductor mediums sharing the same controller.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:



US 2009/0157756

G06F 3/0682

{Tape device}

Definition statement

This subgroup covers:

Being a tape device .

Informative references

Attention is drawn to the following places, which may be of interest for search:

Digital recording/reproducing, formatting on tapes	G11B 20/1201
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G06F 3/0683

{Plurality of storage devices}

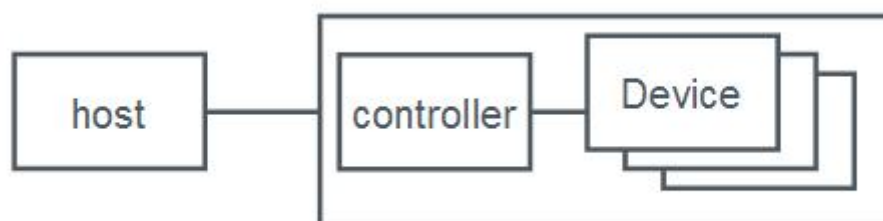
Definition statement

This subgroup covers:

The storage system comprising multiple controllers and a plurality of storage devices .

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:



G06F 3/0685

{Hybrid storage combining heterogeneous device types, e.g. hierarchical storage, hybrid arrays}

Definition statement

This subgroup covers:

The storage system comprising multiple controllers and multiple storage medium types e.g. SSD, HDD and tapes combined; FC-HDD, SATA-HDD, SCSI-HDD combined

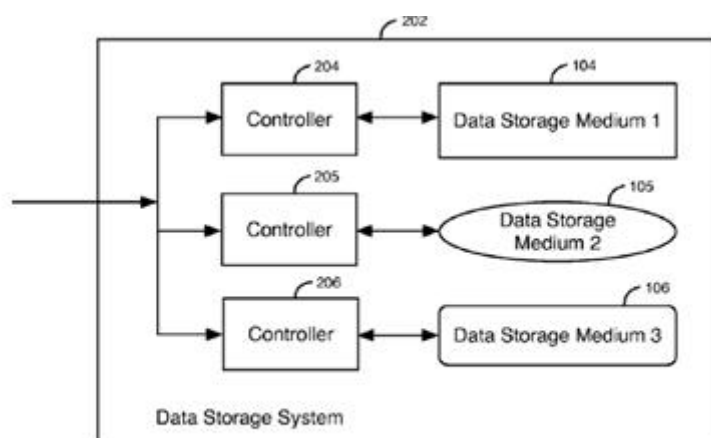
Informative references

Attention is drawn to the following places, which may be of interest for search:

User address space allocation in block erasable memory	G06F 12/0246
Auxiliary circuits for EPROMs	G11C 16/06

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:



US 2009/0157756

G06F 3/0686

{Libraries, e.g. tape libraries, jukebox}

Definition statement

This subgroup covers:

A storage system providing automatic access to multiple media cartridges typically via an automatic loading robot e.g. tape library, media changer, juke box.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Control of automated cassette changing arrangements	G11B 15/689
Control systems for magazines of disc records	G11B 17/22

G06F 3/0688

{Non-volatile semiconductor memory arrays}

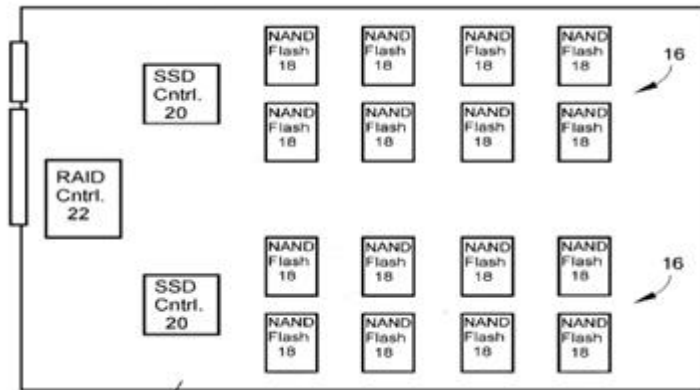
Definition statement

This subgroup covers:

A storage system comprising multiple controllers and multiple semiconductor storage devices.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:



G06F 3/0689

{Disk arrays, e.g. RAID, JBOD}

Definition statement

This subgroup covers:

A storage system comprising multiple controllers and multiple spinning disk drives e.g. RAID, JBOD.

References relevant to classification in this subclass/group

This subgroup does not cover:

Error Correction Coding (ECC) for RAID	G06F 11/1076
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

RAID: Redundant Array of Independent Disks (originally: of Inexpensive disks)

JBOD: Just a Bunch Of Drives

G06F 3/08

from or to individual record carriers, e.g. punched card, {memory card, integrated circuit [IC] card, smart card (record carriers for use with machines and with at least a part designed to carry digital markings [G06K 19/00](#); coded identity card or credit card with a coded signal [G07F 7/10](#))}

Definition statement

This subgroup covers:

Interfaces between a host or a plurality of hosts and a memory card reader or a plurality of memory card readers in relation to the data/command path and data placement techniques.

References relevant to classification in this subclass/group

This subgroup does not cover:

Active credit-cards provided with means to personalise their use	G07F 7/1008
Methods or arrangements for sensing record carriers	G06K 7/00
Information transfer using universal interface adapter	G06F 13/382
Record carriers with integrated circuit chips	G06K 19/07

Informative references

Attention is drawn to the following places, which may be of interest for search:

memory card, integrated circuit (IC) card, smart card, record carriers for use with machines and with at least a part designed to carry digital markings	G06K 19/00
coded identity card or credit card with a coded signal	G07F 7/10

Synonyms and Keywords

Memory card, Integrated Circuit (IC) card, Smart card, Intelligent card, Active card

G06F 3/09

Digital output to typewriters

Definition statement

This subgroup covers:

Old technology related to interfaces with typewriters.

Special rules of classification within this subclass/group

Not used for classification of new documents.

G06F 3/1201

{Dedicated interfaces to print systems}

Definition statement

This subgroup covers:

Interfaces between a host or a plurality of hosts and a printer device or a plurality of printer devices. Techniques for preparing the print job, sending it to a printer and printing it.

References relevant to classification in this group

This subgroup does not cover:

Digital output to typewriter	G06F 3/09
Printing of alphanumeric characters	G06K 15/02
Special arrangements for scanning and reproduction of pictures, e.g. photographs, facsimile	H04N 1/00
Controlling a printer in view of its graphical performance	B41J 29/393

Special rules of classification within this group

This group contains older documents (published before the year 2000) from which the majority are not reorganised in the [G06F 3/1201](#) and its subgroups. No new/recent documents should be classified in [G06F 3/1201](#).

Each new document should receive regarding "invention information":

- at least one class in the sub-groups of [G06F 3/1202](#) for the technical effect achieved;
- at least one class in the sub-groups of [G06F 3/1223](#) for the technique used and
- optionally one class in the sub-groups of [G06F 3/1278](#) for the infrastructure involved.

Class in [G06F 3/1278](#) is added only if the infrastructure plays a major role in the "invention information".

The classification of "additional information" is optional.

Indexing Code symbols in the sub-groups of [G06F 3/1202](#) and/or [G06F 3/1223](#) and/or [G06F 3/1278](#) and/or [G06F 2206/15](#) should be used for classifying "additional information".

The older documents should be retrieved using Indexing Codes:

- [G06F 3/1293](#) Printer information exchange with computer;
- [G06F 3/1294](#) Status or feedback related to information exchange;
- [G06F 3/1295](#) Buffering means;
- [G06F 3/1296](#) Printer job scheduling or printer resource handling;
- [G06F 3/1297](#) Printer code translation, conversion, emulation, compression; Configuration of printer parameters;
- [G06F 3/1298](#) Printer language recognition, e.g. program control language, page description language.

The "additional information" can be found by combining the above Indexing Code(s) with the Indexing Code [G06F 3/1201](#).

Synonyms and Keywords

In patent documents the following words "image forming device/apparatus", "image processing device/apparatus", "image printing device/apparatus", "image output device/apparatus", "image control device/apparatus" and "information processing device/apparatus" and "MFP Multi-Function Printer" are often used as synonyms.

G06F 3/1202

{specifically adapted to achieve a particular effect}

Special rules of classification within this subclass/group

This group is not used for classifying documents in it, but to introduce one of the three classification criteria mentioned in the "Special rules for classification" section of [G06F 3/1201](#).

G06F 3/1203

{Improving or facilitating administration, e.g. print management}

Definition statement

This subgroup covers:

All general aspects of printing management which do not fit in the sub-groups.

G06F 3/1204

{resulting in reduced user or operator actions, e.g. presetting, automatic actions, using hardware token storing data}

Definition statement

This subgroup covers:

Preventing the user or operator from / avoiding the need for doing complicated and burdensome actions related to the printing of a document.

G06F 3/1205

{resulting in increased flexibility in print job configuration, e.g. job settings, print requirements, job tickets}

Definition statement

This subgroup covers:

Assisting or helping the user during print job configuration, e.g. increasing granularity in job configuration, achieving more customised settings, proposing suitable settings, preventing selection of incompatible or undesirable print options.

Special rules of classification within this group

This group is usually combined with [G06F 3/1253](#) and its sub-groups in order to characterise the technique for the "invention information".

G06F 3/1206

{resulting in increased flexibility in input data format or job format or job type}

Definition statement

This subgroup covers:

Assisting or helping the user to send a print job regardless of the format or type of data that should be printed. Facilitating usage of old print systems with new print systems, more specifically when compatibility between old data formats and new data formats should be achieved.

G06F 3/1207

{resulting in the user being informed about print result after a job submission}

Definition statement

This subgroup covers:

All aspects that make the user aware of what happened with the print job after it being sent.

Special rules of classification within this group

This group is usually combined with [G06F 3/1259](#) and its sub-groups in order to characterise the technique for the "invention information".

G06F 3/1208

{resulting in improved quality of the output result, e.g. print layout, colours, workflows, print preview}

Definition statement

This subgroup covers:

Assisting the user to increase the quality of print output (e.g. matching print output to what was intended by the user, increasing the appeal of the print output), e.g. by using preview screens, test printing. Actions or processing directed to higher fidelity.

Special rules of classification within this group

This group is usually combined with [G06F 3/1253](#) and its sub-groups in order to characterise the technique for the "invention information".

G06F 3/1209

{resulting in adapted or bridged legacy communication protocols, e.g. emulation, protocol extension}

Definition statement

This subgroup covers:

Facilitating usage of old print systems with new print systems, more specifically when compatibility between protocols should be achieved. Modifying/enhancing legacy communication protocols to extend their use into (additional) printing environments or print-related functionality (e.g. modifying Bluetooth to adapt to printing --> Basic Printing Profile (BPP)).

G06F 3/121

{Facilitating exception or error detection and recovery, e.g. fault, media or consumables depleted}

Definition statement

This subgroup covers:

Assisting or helping the user to predict or deal with faults, e.g. device faults, lack of consumables, communication errors. Recovering from faults.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Error or fault reporting or storing	G06F 11/0766
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G06F 3/1211

{Improving printing performance}

Definition statement

This subgroup covers:

All aspects of making the job to be printed faster that do not fit in the subgroups.

G06F 3/1212

{achieving reduced delay between job submission and print start}

Definition statement

This subgroup covers:

Decreasing the time between sending a print job (e.g. pressing "print" button) and actual start of the same job at the print device.

G06F 3/1213

{at an intermediate node or at the final node}

Definition statement

This subgroup covers:

Achieving decreasing the time at the node where the job is either temporarily stored (e.g. computer, server, printer) or actually printed (the printer).

G06F 3/1214**{at the submitting node}****Definition statement***This subgroup covers:*

Achieving decreasing the time at the node where the job is initiated from (e.g. computer, server, printer).

G06F 3/1215**{achieving increased printing speed, i.e. reducing the time between printing start and printing end}****Definition statement***This subgroup covers:*

Decreasing the time actually spent to print the job, once printing has commenced, at the print device.

References relevant to classification in this group*This subgroup does not cover:*

Reducing the time between arriving of the job at the printer till actual print process starts.	G06F 3/1213.
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G06F 3/1217**{achieving reduced idle time at the output device or increased asset utilization}****Definition statement***This subgroup covers:*

Decreasing the time during which the printer is doing nothing.

G06F 3/1218**{Reducing or saving of used resources, e.g. avoiding waste of consumables or improving usage of hardware resources}****Definition statement***This subgroup covers:*

Saving resources of the printer used for printing a job.

G06F 3/1219**{with regard to consumables, e.g. ink, toner, paper}****Definition statement***This subgroup covers:*

Preventing waste of used consumables (see for example US2011051164).

G06F 3/122**{with regard to computing resources, e.g. memory, CPU}****Definition statement***This subgroup covers:*

Optimal usage of system's hardware resources.

References relevant to classification in this group*This subgroup does not cover:*

Reducing the number of required printer devices	G06F 3/1217 .
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G06F 3/1221**{with regard to power consumption}****Definition statement***This subgroup covers:*

Power saving; reducing energy consumption.

Special rules of classification within this group

This group is usually combined with [G06F 3/1229](#) and its sub-groups in order to characterise the technique for the "invention information".

G06F 3/1222**{Increasing security of the print job}****Definition statement***This subgroup covers:*

Adding secure aspects to a print job. Preventing unauthorised printing of a job, limiting the printing based on user credentials.

Special rules of classification within this group

This group is usually combined with [G06F 3/1238](#), [G06F 3/1239](#) or [G06F 3/1234](#) in order to characterise the technique for the "invention information".

G06F 3/1223

{specifically adapted to use a particular technique}

Special rules of classification within this subclass/group

This group is not used for classifying documents in it, but to introduce one of the three classification criteria mentioned in the "Special rules for classification" section of [G06F 3/1201](#).

G06F 3/1224

{Client or server resources management}

Definition statement

This subgroup covers:

All aspects that deal with the software or hardware resources of the client or server which do not fit in the sub-groups (see e.g. US2011013223, US2009007151).

G06F 3/1225

{Software update, e.g. print driver, modules, plug-ins, fonts}

Definition statement

This subgroup covers:

Updating or installing printer drivers on the client or server. Adding additional functionality to existing printer drivers (e.g. installing plug-ins, downloading printer definition files). Support for newly installed printers by replacing/updating existing drivers.

G06F 3/1226

{Discovery of devices having required properties}

Definition statement

This subgroup covers:

The client or the server sends requests to find suitable printers for printing based on certain requirements, e.g. colour, double side printing, finishing options, status, location, supported encryption, etc.

References relevant to classification in this group

This subgroup does not cover:

Device discovery specifically adapted for a queued job and aiming at e.g. load balancing or optimised printing	G06F 3/126
Printer device status.	H04L 29/08
Network management in general	H04L 12/24

G06F 3/1227

{Printer definition files}

Definition statement

This subgroup covers:

Printer properties and commands to invoke/execute the printing properties are described in a separate file and can be used by an application program to convert a print job according to certain printer properties without a printer driver. The file can be used by the printer driver as well, e.g. for supporting different printers (see e.g. "Service Item File" in US6897974).

References relevant to classification in this group

This subgroup does not cover:

Driverless printing	G06F 3/1228
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G06F 3/1228

{Printing driverless or using generic drivers}

Definition statement

This subgroup covers:

Specific printer drivers are not used but also printer definition files are not used. Usually a thin client with limited resources is involved. Generic drivers normally are designed to support plurality of different types/models of printers and/or different operating systems.

G06F 3/1229

{Printer resources management or printer maintenance, e.g. device status, power levels}

Definition statement

This subgroup covers:

Device status when checked only in relation to printing of a job - power-level (e.g. on, off, power saving mode), operating or not, reasons for the malfunctions. Logging of device status. All aspects for managing the device which do not fit in the sub-groups.

References relevant to classification in this group

This subgroup does not cover:

Print job status.	G06F 3/1259
Device discovery in general	H04L 29/08
Network management in general	H04L 12/24

G06F 3/123

{Software or firmware update, e.g. device firmware management}

Definition statement

This subgroup covers:

Downloading or updating of printer's firmware. Installing new software for supporting newly added hardware or additional functions (e.g. image processing functions, resident fonts, support for new data formats).

G06F 3/1231

{Device related settings, e.g. IP address, Name, Identification}

Definition statement

This subgroup covers:

Update or initialisation of the printer specific properties - IP address, Device name (see e.g. EP1372059, US2005151988).

References relevant to classification in this group

This subgroup does not cover:

Printer device capabilities	G06F 3/1232
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G06F 3/1232

{Transmitting printer device capabilities, e.g. upon request or periodically}

Definition statement

This subgroup covers:

Transmitting to the requestor printing device capabilities, e.g. double side printing, finishing options, dpi, colour or b/w, ppm (see e.g. EP1435565, EP1178393).

References relevant to classification in this group

This subgroup does not cover:

Printer device properties/settings, not related to printing capabilities, i.e. IP address. This aspect is covered in	G06F 3/1231 .
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G06F 3/1234

{Errors handling and recovery, e.g. reprinting ([G06F 3/1261](#) takes precedence)}

Definition statement

This subgroup covers:

How to handle received jobs or the job currently being printed in case of error, e.g. reprint only the portion that was not printed, reprint the full job, delete the job and ask the host to send it again.

References relevant to classification in this group

This subgroup does not cover:

Alternate printer taking over the job from the failed device.	G06F 3/1261 .
Device malfunctions which do not involve sending a print job.	G06F 11/0766 .

Informative references

Attention is drawn to the following places, which may be of interest for search:

Error or fault reporting or storing	G06F 11/0766
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G06F 3/1235

{caused by end of consumables, e.g. paper, ink, toner}

Definition statement

This subgroup covers:

Specific aspects for recovering from errors caused by end of consumables - paper, ink, toner.

G06F 3/1236

{Connection management}

Definition statement

This subgroup covers:

All aspects relating to connection between devices - client<->printer, server<->printer, printer<->printer. (see e.g. US2011019231 or US2011019231).

G06F 3/1237

{Print job management}

Definition statement

This subgroup covers:

General aspects of job management that do not fit in the sub-groups.

References relevant to classification in this group

This subgroup does not cover:

Print device management	G06F 3/1229
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G06F 3/1238

{Secure printing, e.g. user identification, user rights for device usage, unallowed content, blanking portions or fields of a page, releasing held jobs}

Definition statement

This subgroup covers:

Based on user/content credentials allowing/disabling usage of the printer as a whole.

References relevant to classification in this group

This subgroup does not cover:

Virus detection and handling.	G06F 21/56
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G06F 3/1239

{Restricting the usage of resources, e.g. usage or user levels, credit limit, consumables, special fonts}

Definition statement

This subgroup covers:

Limiting the use of printing as such (e.g. credit limit) or limiting the use of printers (e.g. time the printer can be used, e.g. only 1 hour a day, only after 17:00). Restricting configuration options, e.g. to plain paper, to black ink only, double-sided or n-up printing, lower resolution, limited image effects.

Special rules of classification within this group

This group is usually combined with [G06F 3/1219](#) or [G06F 3/122](#) in order to characterise the effect achieved by the "invention information".

G06F 3/124

{Parallel printing or parallel ripping}

Definition statement

This subgroup covers:

Printing or ripping several portions of a job at the same time.

Special rules of classification within this group

This group is usually combined with [G06F 3/1215](#) in order to characterise the effect achieved by the "invention information".

G06F 3/1241

{Dividing a job according to job requirements, e.g. black/white and colour pages, covers and body of books, tabs}

Definition statement

This subgroup covers:

Print job is divided and different parts are sent to different devices having different properties.

References relevant to classification in this group

This subgroup does not cover:

Dividing for parallel printing	G06F 3/124
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G06F 3/1242

{Image or content composition onto a page}

Definition statement

This subgroup covers:

Composing or overlaying content from different sources, e.g. different documents, onto a page.

Informative references

Attention is drawn to the following places, which may be of interest for search:

2D [Two Dimensional] image generation	G06T 11/60
Image acquisition	G06K 9/20

G06F 3/1243

{Variable data printing, e.g. document forms, templates, labels, coupons, advertisements, logos, watermarks, transactional printing, fixed content versioning}

Definition statement

This subgroup covers:

Print data for a page is generated by combining two sets of content (such as text, graphics and images), one set being constant from page to page (fixed content) and the other set being different (variable content) for every page. The combining of fixed and variable data may take place at any step in a print workflow.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Editing, e.g. insert/delete	G06F 17/24
Document retrieval systems	G06F 17/30011

G06F 3/1244

{Job translation or job parsing, e.g. page banding}

Definition statement

This subgroup covers:

All aspects of transforming the print job in order to be printed which do not fit in the sub-groups, e.g. parsing in order to eliminate repetitive data, colour transformation, font transformation.

G06F 3/1245

{by conversion to intermediate or common format}

Definition statement

This subgroup covers:

Conversion or translation of the initial document or print job to a format which is not yet ready to be handled by a target printer but is useful for certain manipulation, e.g. faster to transmit, more efficient to store, easy to secure. Conversion or translation to a format which, although it could be suitable to certain printers, may not be suitable for the target printer (e.g. converting to a print format before target printer is known).

G06F 3/1246

{by handling markup languages, e.g. XSL, XML, HTML}

Definition statement

This subgroup covers:

Parsing of print jobs written in one of the mark-up languages.

G06F 3/1247

{by conversion to printer ready format}

Definition statement

This subgroup covers:

Conversion or translation of the initial print job (or the job in an intermediate format) to a format which is ready to be handled by the target printer.

G06F 3/1248

{by printer language recognition, e.g. PDL, PCL, PDF}

Definition statement

This subgroup covers:

Parsing of the job in order to find a certain mark (or keyword) that identify the language of the job.

G06F 3/125

{Page layout or assigning input pages onto output media, e.g. imposition}

Definition statement

This subgroup covers:

Arrangement of the product's pages (e.g. document pages) on the output medium (e.g. paper sheets or media roll).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Pagination	G06F 17/217
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G06F 3/1251

{for continuous media, e.g. web media, rolls}

Definition statement

This subgroup covers:

Specifically adapted to when media to be fed by the printer is of long length, e.g. web media, rolls.

G06F 3/1252

{for sheet based media}

Definition statement

This subgroup covers:

Specifically adapted to when media to be fed by the printer is of short length, e.g. sheets (regardless of whether said media is to be folded or cut after printing. See e.g. US2010039670).

G06F 3/1253

{Configuration of print job parameters, e.g. using UI at the client}

Definition statement

This subgroup covers:

All aspects of configuring how the job should be printed which do not fit in the sub-groups.

G06F 3/1254

{Automatic configuration, e.g. by driver}

Definition statement

This subgroup covers:

Automatic allocation of (some) print settings by software, e.g. print driver, (on the client or server) when a print job is to be printed.

Special rules of classification within this group

Double classification possible if [G06F 3/1239](#) also apply.

G06F 3/1255

{Settings incompatibility, e.g. constraints, user requirements vs. device capabilities}

Definition statement

This subgroup covers:

Limiting the possibilities given to the user at the time of configuring print job, e.g. in b/w printer hide the option for colour printing, hide the option for double side printing if the printer does not support it or if "transparencies" is selected as media (see e.g. WO2010016234).

Comparing how the job should be printed and what the printer can offer when the job is sent from the client. Automatic adjusting of some of job's settings in order to fit the printer's settings or asking the user to solve the conflict settings manually (see e.g. EP1986410).

Special rules of classification within this group

This group is usually combined with [G06F 3/1204](#) or [G06F 3/1208](#) in order to characterise the effect achieved by the "invention information".

G06F 3/1256

{User feedback, e.g. print preview, test print, proofing, pre-flight checks}

Definition statement

This subgroup covers:

Techniques for checking how the job will look like when printed either by using a preview on a display, by checks performed by software (pre-flight, pre-press) or by real print of part of the job.

Special rules of classification within this group

This group is usually combined with [G06F 3/1208](#) in order to characterise the effect achieved by the "invention information"

G06F 3/1257

{by using pre-stored settings, e.g. job templates, presets, print styles}

Definition statement

This subgroup covers:

Previously defined settings are stored (e.g. as a template) and, when configuring a new print job, the stored settings are used instead of selecting a value for each print option.

References relevant to classification in this group

This subgroup does not cover:

Document templates, i.e. fixed content..	G06F 3/1242
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Special rules of classification within this group

This group is usually combined with [G06F 3/1204](#) in order to characterise the effect achieved by the "invention information".

G06F 3/1258

{by updating job settings at the printer}

Definition statement

This subgroup covers:

Changing/updating of settings of a received or currently being created print job using UI of the printer.

G06F 3/1259

{Print job monitoring, e.g. job status}

Definition statement

This subgroup covers:

Supervising of a print job after being sent for printing, e.g. printed, failed, queued. Job status can be requested (by the sending node) or received automatically after job sending.

References relevant to classification in this group

This subgroup does not cover:

Printer device status	G06F 3/1229 .
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Special rules of classification within this group

This group is usually combined with [G06F 3/1207](#) in order to characterise the effect achieved by the "invention information".

G06F 3/126

{Job scheduling, e.g. queuing, determine appropriate device}

Definition statement

This subgroup covers:

Techniques relating to where and/or when the job should be printed which do not fit in the sub-groups. Queuing the jobs before printing, e.g. waiting a long job to finish. Finding a printer based on the job requirements.

References relevant to classification in this group

This subgroup does not cover:

Determining appropriate device aiming at providing the user with more print destinations or at installing required software for discovered devices	G06F 3/1226 .
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G06F 3/1261

{by using alternate printing}

Definition statement

This subgroup covers:

Determining different (alternative) device for printing a job if the designated device can not print the job, e.g. due to failure, lacking of resources or excessive delay expected (see e.g. US7027169).

References relevant to classification in this group

This subgroup does not cover:

The same job printed by the same print device after recovered from a failure (i.e. reprinted)	G06F 3/1234
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G06F 3/1262

{by grouping or ganging jobs}

Definition statement

This subgroup covers:

Combining several print jobs in one job (group job), printing print jobs in batches (e.g. jobs requiring same media or same post-processing, jobs submitted by the same user or intended for the same recipient) (see e.g. WO2008039689).

G06F 3/1263

{based on job priority, e.g. re-arranging the order of jobs, e.g. the printing sequence}

Definition statement

This subgroup covers:

Changing the order of print jobs according certain priorities - either user-defined or automatically determined.

G06F 3/1264

{by assigning post-processing resources}

Definition statement

This subgroup covers:

Determining resources to perform actions/functions on printed output (i.e. after printing) as specified by the job settings (e.g. folding, cutting, trimming, binding).

G06F 3/1265

{Printing by reference, e.g. retrieving document/image data for a job from a source mentioned in the job}

Definition statement

This subgroup covers:

The print job as submitted does not comprise the document or print data that should be printed but only a reference to it or to its location (e.g. a URL, a file path). The document is later (e.g. when queuing the job or shortly before printing should commence) obtained from its location.

G06F 3/1267

{Job repository, e.g. non-scheduled jobs, delay printing}

Definition statement

This subgroup covers:

Storing a print job for a certain time before it being printed (e.g. a job to be printed at or after a certain time) or in case it should be re-printed subsequently. Storing the job until certain condition is fulfilled, e.g. user authorisation, recovering from an error state...

References relevant to classification in this group

This subgroup does not cover:

Normal queuing, e.g. waiting a previous job to finish..	G06F 3/126
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G06F 3/1268

{Job submission, e.g. submitting print job order or request not the print data itself}

Definition statement

This subgroup covers:

Sending a request to print a job. The real job data will be sent or requested later. All aspects of sending a print request (e.g. submitting a document for printing, submitting a print job or a print order) which do not fit in the sub-groups.

References relevant to classification in this group

This subgroup does not cover:

Printing by reference	G06F 3/1265.
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Special rules of classification within this group

Specific ways to send a request to print a job, e.g. scanning a page with a barcode and receiving printed pages with information identified by the barcode from a remote source.

G06F 3/1269

{by broadcasting server}

Definition statement

This subgroup covers:

Server storing user's desires about receiving printed materials, e.g. subscription, and sending personalized print jobs to all users (or users' printers) accordingly.

G06F 3/127

{by using hot folders, e.g. folder for which print settings or print data management rules are set in advance}

Definition statement

This subgroup covers:

Folders with associated printing instructions (e.g. print settings or print-related tasks, such as automatic notifications). When a document or job is sent to a folder it will be processed according to the printing instructions associated with the folder.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Print workflow management	G06F 3/1275
---------------------------	-----------------------------

G06F 3/1271

{Job submission at the printing node, e.g. creating a job from a data stored locally or remotely ([G06F 3/1238](#) takes precedence)}

Definition statement

This subgroup covers:

Using the UI of the printer to configure a new job. The data for the job could be stored on the printer or at a different location, e.g. server.

References relevant to classification in this group

This subgroup does not cover:

Releasing a stored job according to the user identification	G06F 3/1238
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Printing by reference	G06F 3/1265
-----------------------	-----------------------------

G06F 3/1272

{Digital storefront, e.g. e-ordering, web2print, submitting a job from a remote submission screen}

Definition statement

This subgroup covers:

Configuring and submitting a job using online based resources, e.g. accessing remote print service providers, choosing from web based content.

G06F 3/1273

{Print job history, e.g. logging, accounting, tracking}

Definition statement

This subgroup covers:

Creating, managing and using of print job history (see e.g. EP1860546).

G06F 3/1274

{Deleting of print job}

Definition statement

This subgroup covers:

Specifically instructing or managing job deletion based on certain criteria, e.g. memory usage, privacy, avoiding mixing of received jobs (see e.g. US2005275864).

G06F 3/1275

{Print workflow management, e.g. defining or changing a workflow, cross publishing}

Definition statement

This subgroup covers:

Designing or modifying the steps to be performed to a print request from choosing document(s) to be printed to finalising the printed job (e.g. post-processing actions). Adding conditional steps, e.g. what should happen in case of certain events (see e.g. US2008170254).

G06F 3/1276

{within a printer driver, e.g. driver resides either on a server or on a client}

Definition statement

This subgroup covers:

Print workflow management is done by the driver, regardless where it resides - client or server.

G06F 3/1277

{using filter pipeline, e.g. outside the driver, adding traps}

Definition statement

This subgroup covers:

No driver is involved in the filter pipeline. Workflow formed by pieces of software, called "filters" (see e.g. US2002135800).

References relevant to classification in this group

This subgroup does not cover:

Filters within a printer driver.	G06F 3/1276
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G06F 3/1278

{specifically adapted to adopt a particular infrastructure}

Special rules of classification within this subclass/group

This group is not used for classifying documents in it, but to introduce one of the three classification criteria mentioned in the "Special rules for classification" section of [G06F 3/1201](#).

G06F 3/1279

{Controller construction, e.g. aspects of the interface hardware}

Definition statement

This subgroup covers:

All aspects of hardware structure of the interface controller of the printer device if the "invention information" mainly focuses on them.

G06F 3/128

{Direct printing, e.g. sending document file, using memory stick, printing from a camera}

Definition statement

This subgroup covers:

Printing from an USB stick or digital camera directly connected to the printer device.

G06F 3/1281

{Multi engine printer devices, e.g. one entity having multiple output engines}

Definition statement

This subgroup covers:

Printer device having plurality of print engines in order to increase printing speed.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Parallel printing or parallel ripping	G06F 3/124.
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G06F 3/1289

{in server-client-printer device configuration, e.g. the server does not see the printer}

Definition statement

This subgroup covers:

Network configuration where the information from the server to the printer device always goes via the client.

G06F 3/129

{in server-printer device-client configuration, e.g. print flow goes from server to printer and then bidirectional from printer to client, i.e. the client does not communicate with the server}

Definition statement

This subgroup covers:

Network configuration where the client accesses the server via the printer.

G06F 3/14

Digital output to display device; {Cooperation and interconnection of the display device with other functional units} (control of display in general [G09G](#); arrangements for producing a permanent visual presentation of the output data [G06K 15/00](#))

Definition statement

This subgroup covers:

- Interfaces between processor and display system (with or without a standard bus);
- Multiple busses connecting processor, display system and/or other subsystems: e.g. video zoom busses, multimedia busses besides the standard bus.
- Data being furnished to the display system being generated by a multiplicity of sources.
- Data of different types being furnished to the system that displays the data (it can be a display system or a complete computer).
- Interfaces between the host and the display system, especially for system that have a structure different from the structure outlined above (older or special systems).
- Plurality of symbol or graphics generators cooperating with one display unit.
- Aspects of the operating system that have impact on the display system and are not related to a particular aspect of the display physical construction.
- Transferring data from a Internet host to the display system
- kvm-switches, in the case that they switch (also) between a plurality of data sources (i.e. computers).

References relevant to classification in this group

This subgroup does not cover:

Arrangements for producing a permanent visual presentation of the output data	G06K 15/00
Control of display in general	G09G

Informative references

Attention is drawn to the following places, which may be of interest for search:

Kvm-switches, only linked to one computer as data source	G09G 5/006
Audio-visual communications	H04N 7/14

Special rules of classification within this group

- In the first case (standard bus present) the documents will be classified only if they contain details of the standard interface that are peculiar for the display system; in the second case are included all the "non standard" interfaces.
- Data handling that is pertinent neither to the kind of visualisation unit that is used nor to the frame buffer access ([G09G 5/39](#) and subgroups)
- [2001] - Subclass reorganized in 2001. The description of the contents of the class has changed since some parts of the documents have been moved to [G09G](#) (for examples the documents dealing with graphics controllers).
- Old contents:

display cooperating with 2 or more processors in one terminal;

CRT controller cooperating with CRT and flat panel display(s);

power control of the flat panel if a CRT is also present;

detection of the connection of an extra display panel;

plurality of symbol generators cooperating with a plurality of display units;

plurality of displays cooperating with one memory;

workstation controller, console emulation;

- all viable Indexing Codes were assigned to the documents in this group at the moment of reorganisation (begin 2001). So all the documents in the main group ([G06F 3/14](#)) and in the new subgroups (C, C2, C4, C6, T, T1) are completely coded.

[1999] - [G09G 2300/026](#) completely assigned on 3-12-1999.

G06F 3/1415

{with means for detecting differences between the image stored in the host and the images displayed on the displays}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Digital output to display device involving copying of the display data of a local workstation or window to a remote workstation or window so that an actual copy of the data is displayed simultaneously on two or more displays	G06F 3/1462
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G06F 3/1423

{controlling a plurality of local displays, e.g. CRT and flat panel display}

Definition statement

This subgroup covers:

General group for documents in which more than one display unit is connected to the display system, irrespective of the type of display. If it is clear that the display system contains one or more display controllers, then the subgroups C2 and C4 take precedence.

References relevant to classification in this group

This subgroup does not cover:

Using a single graphics controller	G06F 3/1431
Using more than one graphics controller	G06F 3/1438

Special rules of classification within this group

- See [G09G 2360/04](#) for documents where one display (device) controller controls two displays as well as for old documents (up to and including 2001).

Controlling a plurality of local displays, with or without display controller:

- In many cases, when more than one display terminal is controlled by a local host, there are also some details of the display controller present in the document. Should this document be classified in [G06F 3/1423](#) (and subgroups) or in the [G09G 5/363](#) (display controller)? I gave precedence to the [G06F](#) groups. So the "plurality of displays" takes precedence over the "display controller". Of course, the code can be given if the details of the display controller are interesting and not only related to the fact that more than one display terminal is connected to it (Gigi Farricella, 14.05.2001).

Conflict between "plurality of local displays" and "conversion of CRT signals for a flat panel".

- Conflict between [G06F 3/1423](#), C2 and C4 and [G09G 5/366](#): the documents that have to be classified in the latter group might have more than one display, namely the crt AND the lcd. In these cases the documents should have both symbols, in the sense that they have to be classified in one group and receive the CODE of the other group. The choice between class and code is made depending on the content of the document: if the subject matter is mainly the interface, then the [G06F](#) class is preferred, if it is the graphic controller, than the [G09G](#) class is given.

Comments: reorganisation not finished. For search see also [G09G 2360/04](#) .

G06F 3/1431

{using a single graphics controller}

Definition statement

This subgroup covers:

One single graphics controller (VGA, SVGA or other systems) controls two or more display units. Often one graphics controller card has interface circuitry for interfacing to CRT and to flat panel.

Special rules of classification within this group

Documents are classified in [G06F 3/1431](#) or [G06F 3/1438](#) if there is a "graphics controller" present in the system, i.e. an interface between the standard bus and the display terminal that contains a graphics processor and a frame bufer. If the plurality of displays are connected to the host processor in a different, non standard, way, or if it is not possible to determine if a graphics controller is present (like for example in the old fashioned "terminals"), the documents will be classified in [G06F 3/1423](#).

G06F 3/1446

{display composed of modules, e.g. video walls}

Definition statement

This subgroup covers:

Illustrative example of subject matter classified in this group: GB2441353.

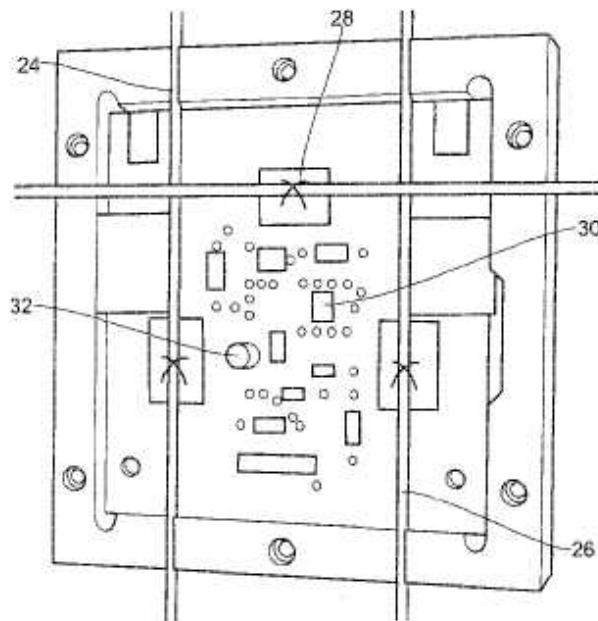


FIG. 3

Special rules of classification within this group

See also [G09G 2300/026](#)

G06F 3/1454

{involving copying of the display data of a local workstation or window to a remote workstation or window so that an actual copy of the data is displayed simultaneously on two or more displays, e.g. teledisplay}

Definition statement

This subgroup covers:

Also screen sharing where the framebuffer is sent to remote displays, as is commonly done in application sharing (well know as Virtual Network Computing (VNC) pn:XP002142727).

Examples:

- pn:WO9201281 - This is a case of "remote display" on X-windows terminals, but the rendering is done centrally, and only the modified sections of the frame buffers are sent to the remote stations. This is a case of "remote" local display. There is no teledisplay in this case because the remote display stations are acting as "terminals" of the host. This document was classified in [G06F 3/1423](#) but a code [G06F 3/1462](#) was given to indicate that the x-Window terminals allow for teledisplay and that only the modified sections of the frame buffers were sent to the display units.
- pn:US5996002 - Another good example of "teledisplay" comes from the abstract: A collaborative work support system that is performed on plural computers each of which is assigned for an operator, and supports collaborative work in which the plural computers display common data and each operator operates the displayed common data through his own computer.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Multiprogramming arrangements; (implementation details of the sharing technique if not framebuffer based, i.e. really the inner workings, exchanged data structures	G06F 9/46 , G06F 9/54
Office automation, groupware	G06Q 10/10
Electronic classroom, remote teaching	G09B 5/00 , G09B 7/00
Network arrangements for conferencing, chatrooms, etc	H04L 12/18
Network protocol for the sharing technique	H04L 29/0602 , H04L 29/06027 , H04L 29/06034
Telephonic multimedia conference systems	H04M 3/567
Videophones	H04N 7/14
Interaction techniques specific for application sharing, as now several users may want to interact with the same display	G06F 3/0481

Special rules of classification within this group

DA wrt CPC: improvement of definition badly required; title requires displaying on two displays; description (teledisplay) appears to require display on remote (self-controlled) display.

Synonyms and Keywords

In patent documents, the following abbreviations are often used:

CSCW	Computer Supported Collaborative Work
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In patent documents, the following expressions/words "Application sharing" and "Shared application" are often used as synonyms.

In patent documents, the following expressions/words "Groupware" and "Computer Supported Collaborative Work" are often used as synonyms.

G06F 3/1462

{with means for detecting differences between the image stored in the host and the images displayed on the remote displays}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Digital output to display device with means for detecting differences between the image stored in the host and the images displayed on the displays	G06F 3/1415
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G06F 3/147

using display panels

Definition statement

This subgroup covers:

Display panels: LEDs, PDP, LCD, etc. Interconnection of POS (point of sales) terminals. For details see [G06F 3/14](#).

References relevant to classification in this group

This subgroup does not cover:

Arrangements of circuits for control of indicating devices using static means to present variable information	G09G
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Data processing in buying/selling transactions, e.g. when dealing with POS terminals	G06Q 30/06
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Services or facilities specially adapted for wireless communication networks	H04W 4/00
Services making use of the location of users or terminals	H04W 4/02
In a dedicated environment, e.g. buildings or vehicles	H04W 4/04

Special rules of classification within this group

[1999] - [G09G 2300/026](#) completely assigned on 3-12-1999.

G06F 3/1475

{with conversion of CRT control signals to flat panel control signals, e.g. adapting the palette memory}

Informative references

Attention is drawn to the following places, which may be of interest for search:

with conversion of CRT control signals to flat panel control signals	G09G 5/366
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G06F 3/16

Sound input; Sound output (conversion of speech into digital information or vice versa [G10L](#))

Definition statement

This subgroup covers:

General computer sound interfaces for interaction with computer programs or users

Relationship between large subject matter areas

- information retrieval of audio data [G06F 17/3074](#);
- production of synthetic speech signals [G10L 13/00](#);
- recognition of speech [G10L 15/00](#);
- measurement of sound waves in general [G01H](#);
- image data processing [G06T](#);
- teaching or communicating with the blind, deaf or mute [G09B](#);
- electronic musical instruments [G10H](#);
- sound production [G10K](#)
- information storage, e.g. sound storage, [G11B](#);
- electronic circuits for sound generation [H03B](#);

- electronic filters [H03H](#);
- coding, decoding or code conversion, error protection in general [H03M](#);
- telephonic communication [H04M](#);
- switching systems [H04Q](#)
- microphone arrangements, hearing aids, public address systems [H04R](#);
- spatial sound reproduction [H04S](#);

References relevant to classification in this subclass/group

This subgroup does not cover:

- processing of speech or voice signals in general (**G10L11/00**);
- production of synthetic speech signals ([G10L 13/00](#));
- recognition of speech ([G10L 15/00](#));
- coding/decoding of audio signals for compression and expansion ([G10L 19/00](#));
- modification of speech signals, speech enhancement, source separation ([G10L 21/00](#));
- noise filtering or echo cancellation in an audio signal ([G10L 21/00](#));
- devices for the storage of speech signals ([G11B 27/00](#));
- spatial sound recording ([H04R 5/00](#))
- spatial sound reproduction ([H04S](#))
- encoding of compressed speech signals for transmission or storage ([H04L](#)).
- coding of audio signals in musical instruments ([G10H](#))
- karaoke or singing voice processing ([G10H](#))
- amplifiers ([H03F](#))
- gain or frequency control ([H03G 3/00](#))
- broadcasting ([H04H](#))
- handling natural language data ([G06F 17/20](#))

G06F 3/162

{Interface to dedicated audio devices, e.g. audio drivers, interface to CODECs}

Definition statement

This subgroup covers:

Dedicated hardware or software components for interfacing to an audio device i.e. translating the audio stream from a host into a format accepted by the audio device and vice-versa. Providing hardware emulation for an audio source. Intermediation with OS when receiving audio to preserve sound quality. Connecting a host to a mobile phone to aid processing audio to enhance quality Adapting drivers to different audio source formats

References relevant to classification in this subclass/group

This subgroup does not cover:

Interfacing to a peripheral in general: [G06F 13/385](#) CODECs as such:
G10L19/14

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

CODEC: coding / decoding, compression/decompression of an audio signal.

Synonyms and Keywords

CODEC audio device driversound card driver

G06F 3/165

{Management of the audio stream, e.g. setting of volume, audio stream path}

Definition statement

This subgroup covers:

Management from a host of the audio device by means of the interface control for modifying the operation of the audio device. Only for control of the audio device/sytem from the host. Controlling the audio settings such as volume, mute, filters ... Controlling the audio stream path (switch output destination). Switch on or off of computer audio devices. Controlling the audio play, pause, replay.

References relevant to classification in this subclass/group

This subgroup does not cover:

Dedicated to TV appliances: [H04N 7/00](#) Control of streaming: [H04L 29/06](#)
Control of speech to text / text to speech conversion: [G10L 13/00](#) and
[G10L 15/00](#)

G06F 3/167

{Audio in a user interface, e.g. using voice commands for navigating, audio feedback}

Definition statement

This subgroup covers:

Interface to a computer user by means of an audio device to send commands to the computer or receive feed-back on an action. Limited to the navigation in a menu and sending control commands. Moving a mouse pointer on a screen

using audio. Scrolling through a menu using audio. User interface of an audio card. Audio indicators to focus attention.

References relevant to classification in this subclass/group

This subgroup does not cover:

User interaction and feedback in general: [G06F 3/01](#) User interaction in a menu in general: [G06F 3/048](#) Speech recognition per se: [G10L 15/26](#), [G10L 15/22](#)

G06F 5/00

Methods or arrangements for data conversion without changing the order or content of the data handled (by coding or decoding [H03M](#))

Definition statement

This group covers:

Data format conversions; Conversion between packed and unpacked BCD.

References relevant to classification in this group

This group does not cover:

Parallel-serial conversion. Code conversion	H03M 9/00 , H03M 5/00 , H03M 7/00
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Coding, decoding or code conversion, in general	H03M
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Special rules of classification within this subclass/group

Use of Indexing Codes

ECLA reformed field, i.e. all ECLA classes have a corresponding [G06F](#) Indexing Code-code, which is to be used for secondary aspects (non-invention information).

G06F 5/01

for shifting, e.g. justifying, scaling, normalising {(digital stores in which the information is moved stepwise, e.g. shift-registers [G11C 19/00](#); digital stores in which the information circulates [G11C 21/00](#))}

Definition statement

This subgroup covers:

Shifting which modifies the value being shifted, e.g. in arithmetic or for implementing shift instructions in processors; in particular the shifting functionality provided and the logic implementing it.

References relevant to classification in this group

This subgroup does not cover:

Electrical details of cells	G11C
Digital stores in which the information is moved stepwise, e.g. shift-registers	G11C 19/00
Digital stores in which the information circulates	G11C 21/00
Exception handling	G06F 7/49905
Rounding	G06F 7/49942
Sign extension	G06F 7/49994

Special rules of classification within this group

Use of Indexing Codes:

Indexing Codes [G06F 7/49905](#), [G06F 7/49942](#), [G06F 7/49994](#) are use for secondary aspects (non-invention information).

G06F 5/012

{in floating-point computations}

Definition statement

This subgroup covers:

Details of the shifting arrangement.

References relevant to classification in this group

This subgroup does not cover:

Denomination or exception handling	G06F 7/499
------------------------------------	----------------------------

G06F 5/015

{having at least two separately controlled shifting levels, e.g. using shifting matrices ([G06F 5/012](#) takes precedence)}

Definition statement

This subgroup covers:

For example, barrel shifter with multiple shifting stages.

References relevant to classification in this group

This subgroup does not cover:

Methods or arrangements for data conversion without changing the order or content of the data handled for shifting in floating-point computations	G06F 5/012
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G06F 5/06

for changing the speed of data flow, i.e. speed regularising {or timing, e.g. delay lines, FIFO buffers; over- or underrun control therefor; ([G06F 7/78](#) takes precedence)}

Definition statement

This subgroup covers:

E.g. Shift registers with certain functionality and logic implementing it.

E.g. Buffer systems in general.

E.g. Fifos using linked lists.

E.g. Fifos of the types "shift-in, individual-out" or "individual -in, shift-out".

E.g. Effectuating transfer of data between different clock domains

References relevant to classification in this group

This subgroup does not cover:

FIFOs having (limited) facilities for outputting other than the first data items, e.g. "either first or second out"	G06F 7/78 , G06F 7/785
FIFO with priority-controlled output	G06F 13/18
Reordering based on contents of data in general	G06F 7/22

G06F 5/065

{Partitioned buffers, e.g. allowing multiple independent queues, bidirectional FIFO's}

References relevant to classification in this group

This subgroup does not cover:

Addressing methods of the memory	G06F 12/02 , G11C 8/00
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G06F 5/08

having a sequence of storage locations, the intermediate ones not being accessible for either enqueue or dequeue operations, e.g. using a shift register {([G06F 5/065](#) takes precedence; shift registers per se [G11C 19/00](#))}

Definition statement

This subgroup covers:

E.g. physical shifting of data.

References relevant to classification in this group

This subgroup does not cover:

FIFOs of the types "shift-in, individual-out" or "individual-in, shift-out"	G06F 5/06
Partitioned buffers, e.g. allowing multiple independent queues, bidirectional FIFO's	G06F 5/065
Shift registers per se	G11C 19/00

G06F 5/10

having a sequence of storage locations each being individually accessible for both enqueue and dequeue operations, e.g. using random access memory {([G06F 5/065](#) takes precedence)}

References relevant to classification in this group

This subgroup does not cover:

FIFOs of the types "shift-in, individual-out" or "individual-in, shift-out"	G06F 5/06
Partitioned buffers, e.g. allowing multiple independent queues, bidirectional FIFO's	G06F 5/065

Addressing methods of the memory	G06F 12/02 , G11C 8/00
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G06F 5/12

Means for monitoring the fill level; Means for resolving contention, i.e. conflicts between simultaneous enqueue and dequeue operations

Definition statement

This subgroup covers:

E.g. signal generated / action taken before buffer runs full/empty.

G06F 5/14

for overflow or underflow handling, e.g. full or empty flags

Definition statement

This subgroup covers:

Signal generated / action taken when buffer is already full/empty.

G06F 5/16

Multiplexed systems, i.e. using two or more similar devices that are alternately accessed for enqueue and dequeue operations, e.g. ping pong buffers

Definition statement

This subgroup covers:

E.g. Alternating address by address, i.e. Odd-even.

References relevant to classification in this group

This subgroup does not cover:

Addressing methods of the memory	G06F 12/02 , G11C 8/00
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G06F 7/00

Methods or arrangements for processing data by operating upon the order or content of the data handled (logic circuits [H03K 19/00](#))

Definition statement

This group covers:

The methods and arrangements in this main group are one level above logic circuits.

Examples of such methods and arrangements are: arithmetic circuits implemented using basic logic gates, implementation of complex logic gates, implementation at transistor level, specially designed for arithmetic operations

Other examples are:

Logical operations on words per se;

Finite state machines;

Grey System Theory (method of handling uncertainty),

- Asynchronous digital pipeline = clock-less operation of logical operations.

References relevant to classification in this group

This group does not cover:

Logic circuits, i.e. Implementation of basic logical circuits (AND, NAND, OR, NOR, EXOR, EXNOR), at transistor level	H03K 19/00
Arrays of processors with common control	G06F 15/80
Information retrieval, or database structures therefor	G06F 17/30
Complex mathematical operations	G06F 17/10
Logical operations on words in combination with arithmetic operations	G06F 7/57
Conversion between different representations of Boolean functions, e.g. Boolean formula synthesis from Karnaugh maps, generation of Reed-Muller expansions	G06F 17/00

Special rules of classification within this group

Use of Indexing Codes:

All ECLA classes have a corresponding [G06F](#) Indexing Code-code, which is to be used for secondary aspects (non-invention information).

Indexing Codes in the [G06F 2207/00](#) are used (i.e. compulsory) for invention information in certain ranges only:

[G06F 2207/00](#)+ for the entire [G06F 7/00](#)

[G06F 2207/38](#)+ for [G06F 7/38](#) and subgroups, i.e. [G06F 7/38](#) to [G06F 7/575](#)

[G06F 2207/48](#)+ for [G06F 7/48](#) and subgroups, i.e. [G06F 7/48](#) to [G06F 7/575](#)

[G06F 2207/552](#)+ for [G06F 7/552](#) and subgroup, i.e. [G06F 7/552](#) to [G06F 7/5525](#).

Reconfigurable for different fixed word lengths (multigauge devices G06F 2207/3828) i.e. a restricted number of fixed word-lengths, e.g. single & double precision	G06F 2207/382
Unit distance code e.g. Grey codes	G06F 2207/3848
Clockless, i.e. asynchronous operation used as a design principle (G06F 2207/3888 takes precedence) e.g. using a Muller C-element	G06F 2207/3864
Precharge of output to prevent leakage i.e. precharge in general, not only for leakage prevention	G06F 2207/3872
Pipelining i.e. only synchronous pipelining;	G06F 2207/3884
Bit slicing i.e. data is split into slices of smaller width, each being processed separately	G06F 2207/3896
Cascode or current mode logic i.e. digit determination through current (not voltage)	G06F 2207/4806
Multiplexers used in an unusual way	G06F 2207/4812

Glossary of terms

In this group, the following terms (or expressions) are used with the meaning indicated:

Individual record carriers	Designates physically distinct carriers carrying digital information, e.g. sheets, cards.
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G06F 7/02

Comparing digital values ([G06F 7/06](#), {[G06F 7/22](#), } [G06F 7/38](#) take precedence; information retrieval [G06F 17/30](#); comparing pulses [H03K 5/22](#))

Definition statement

This subgroup covers:

For example, bit string matching, character string matching.

References relevant to classification in this group

This subgroup does not cover:

Arrangements for sorting, selecting, merging or comparing data on individual record carriers	G06F 7/06
Arrangements for sorting or merging computer data on continuous record carriers, e.g. tape, drum, disc	G06F 7/22
Methods or arrangements for performing computations using exclusively denominational number representation, e.g. using binary, ternary, decimal representation	G06F 7/38
Comparing pulses	H03K 5/22
Information retrieval	G06F 17/30

G06F 7/026

{Magnitude comparison, i.e. determining the relative order of operands based on their numerical value, e.g. window comparator}

Definition statement

This subgroup covers:

Magnitude comparison generating less-than, greater-than, equal-to signals.

References relevant to classification in this group

This subgroup does not cover:

Min or max functions producing one of the two input values	G06F 7/544
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Window comparator	determines in which window defined by multiple values a certain value falls
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G06F 7/06

Arrangements for sorting, selecting, merging or comparing data on individual record carriers (sorting of postal letters [B07C](#); conveying record carriers from one station to another [G06K 13/02](#))

Informative references

Attention is drawn to the following places, which may be of interest for search:

Sorting of postal letters	B07C
Conveying record carriers from one station to another	G06K 13/02

G06F 7/22

Arrangements for sorting or merging computer data on continuous record carriers, e.g. tape, drum, disc

Definition statement

This subgroup covers:

E.g. classifying digital data.

E.g. maximum, minimum or median value of a set of data.

References relevant to classification in this group

This subgroup does not cover:

Classifying in pattern recognition	G06K 9/00
Minimum or maximum of two values	G06F 7/544

Synonyms and Keywords

In patent documents the following expression/word "Batcher sorter" , "bitonic sorter" and "odd-even merge"are often used as synonyms.

G06F 7/38

Methods or arrangements for performing computations using exclusively denominational number representation, e.g. using binary, ternary, decimal representation

Definition statement

This subgroup covers:

E.g. documents on number representations without dealing with the technical circuit implementation.

G06F 7/58

Random or pseudo-random number generators {(random pulse generators [H03K 3/84](#); secret telegraphic communication [H04L 9/00](#); lottery apparatus [G07C 15/00](#))}

Definition statement

This subgroup covers:

Generation or transformation of stochastic functions; generation of output with certain random characteristics; post processing, e.g. pattern elimination, whitening, reducing auto-correlation or bias; breakdown detection.

References relevant to classification in this group

This subgroup does not cover:

Transformation of stochastic functions by table look-up	G06F 1/03
Random pulse generators, random bit generators	H03K 3/84
Secret telegraphic communication	H04L 9/00
Lottery apparatus	G07C 15/00

Special rules of classification within this group

Random bit generators: In case of a bit sequence, which could be seen as a random number sequence, classification is done both in the appropriate (sub)group in [G06F 7/58](#) and in [H03K 3/84](#).

Methods both valid for random and pseudo-random number generators should be classified in the head group ([G06F 7/58](#)) and not in a sub-group, even if a specific PRNG/RNG is discussed.

Double classification head group / main group only

- on basis of other aspects, e.g. possibly non-trivial PRNG or RNG also disclosed

- in case it is not sure that the method is valid for both RNG and PRNG

Use of keywords

Pseudo-random number generators i.e. only deterministic PRNGs; mixed RNGs in G06F 7/588 if more than one type of pseudo-random number generator is discussed:- in case these PRNGs are clearly trivial: classify in head group (G06F 7/582) - in case a PRNG might be non-trivial: classify in relevant sub-group(s)	G06F 7/582
Using finite field arithmetic, e.g. using a linear feedback shift register generators including the 2^n state with all zeroes in G06F 7/582	G06F 7/584
Random number generators, i.e. based on natural stochastic processes also mixed PRNG/RNGs Considered as random (G06F 7/588) are methods based on - radioactivity, zener, race, chaos- uncertain moment of pressing a key	G06F 7/588
Using non-contact-making devices, e.g. tube, solid state device; using unspecified devices e.g. 2's complementing	G06F 7/48
Using coordinate rotation digital computer (CORDIC) i.e. CORDIC in non-complex environment: G06F 7/5446	G06F 7/4818
Using signed-digit representation Binary multipliers and dividers often use signed-digit representation internally for one operand or the result; see therefor "recoded" or "Booth" multipliers in G06F 7/523 to G06F 7/5338 and "recoded" or "SRT" dividers in G06F 7/535 to G06F 7/5375 .	G06F 7/4824
Computations with numbers represented by a non-linear combination of denominational numbers, e.g. rational number, logarithmic number system, floating-point numbers (conversion to or from floating-point codes H03M 7/24) (G06F 7/4806 , G06F 7/4824 , G06F 7/49 , G06F 7/491 , G06F 7/544 take precedence) e.g. fused multiply add (FMA) also here, but add G06F 7/5443	G06F 7/483
Logarithmic number system mainly for non-trivial operations such as addition. multiplication of binary operands via the log-domain is in G06F 7/5235	G06F 7/4833
Adding; Subtracting (G06F 7/4833 takes precedence) e.g. floating-point addition	G06F 7/485

Dividing i.e. floating-point division	G06F 7/4873
Multiplying i.e. floating-point multiplication If in fact only the mantissa-multiplication is treated, classification should be made in another group, unless special features for switching between fixed and floating point operands are described.	G06F 7/4876
Computations with a radix, other than binary, 8, 16 or decimal, e.g. ternary, negative or imaginary radices, mixed radix (non-linear PCM, G06F 7/4824 takes precedence) N-ary logic	G06F 7/49
Multiplying; Dividing MULTIPLICATION ONLY division goes into G06F 7/4915 , whether it uses 8421 code or not	G06F 7/496
Mantissa overflow or underflow in handling floating-point number e.g. exponent adjustment	G06F 7/49915
Normalisation mentioned as feature only i.e. use of normalisation Implementation of floating-point normalisers: G06F 5/012	G06F 7/49936
Significance control i.e. number of significant bits	G06F 7/49942
Implementation of IEEE-754 Standard Note: The standard uses sign magnitude representation	G06F 7/49957
Rounding to nearest (G06F 7/49957 takes precedence) Note: The IEEE-754 way is "rounding to nearest even", which is rounds to nearest, and only when exactly in the middle to nearest even. Though rounding to nearest odd may in fact round to an even number, it normally doesn't.	G06F 7/49963
Rounding towards zero (G06F 7/49957 takes precedence) e.g. as in IEEE-754	G06F 7/49978
Rounding away from zero way of rounding not provided for in IEEE-754	G06F 7/49984
Interval arithmetic i.e. computations with intervals as values	G06F 7/49989
Adding; Subtracting (G06F 7/4806 , G06F 7/4824 , G06F 7/483 to G06F 7/491 , G06F 7/544 take precedence) only binary, radix 8, radix 16..	G06F 7/50
using carry switching, i.e. the incoming carry is connected directly to the carry output under control of a carry propagate signal Full adders having in general the form 1-bit adder stages (ripple carry)	G06F 7/503

with simultaneous carry generation for or propagation over two or more stages e.g. using group carry signals, e.g. carry skip; all smart carry schemes except carry look-ahead and carry select/ conditional sum are in G06F 7/506	G06F 7/506
using selection between two conditionally calculated carry or sum values e.g. carry select, conditional sum	G06F 7/507
for multiple operands, e.g. digital integrators i.e. operand-parallel addition of 3 or more operands (this is mainly "3" or "a lot"); multipliers in G06F 7/52	G06F 7/509
word-serial, i.e. with an accumulator-register i.e. OPERAND serial!	G06F 7/5095
Multiplying; Dividing (G06F 7/4806 , G06F 7/4824 , G06F 7/483 to G06F 7/491 , G06F 7/544 take precedence) very rare cases only; normally documents are classified in one of the subgroups (or both) This subgroup does not cover G06F 7/5443 : multiplier-accumulators ($f = \sum a_i \times x_i$), including simple cases $f = ax + b$, $f = ax + by$ G06F15/347 : vector multipliers, matrix multipliers G06F 7/68 : binary rate multipliers/ dividers G06F 7/724 : finite field multipliers	G06F 7/52
In serial-parallel fashion, i.e. one operand being entered serially and the other in parallel (G06F 7/533 takes precedence) In old documents these multipliers are often called "parallel", in newer documents they are often called "serial"!	G06F 7/527
with row-wise addition of partial products i.e. adding two rows each cycle In majority: "add to accumulator and shift"	G06F 7/5272
In parallel-parallel fashion, i.e. both operands being entered in parallel (G06F 7/533 takes precedence) e.g. single cells for cellular array multiplier e.g. arrays of undetermined type	G06F 7/53
Using indirect methods, e.g. quarter-square method, via logarithmic domain if operands stay in the log-domain then G06F 7/4833 ; quarter-square see XP013079891	G06F 7/5235
in serial-serial fashion, i.e. both operands are entered serially (G06F 7/533 takes precedence) e.g. Lyon multipliers (see XP007901470)	G06F 7/525
with row-wise addition of partial products i.e. adding two rows each cycle	G06F 7/5272

with column-wise addition of partial products e.g. adding one column each cycle with a parallel counter	G06F 7/5277
In parallel-parallel fashion, i.e. both operands being entered in parallel (G06F 7/533 takes precedence) e.g. single cells for cellular array multipliers; e.g. arrays of undetermined type	G06F 7/53
With row-wise addition of partial products (G06F 7/5324 takes precedence) cellular array multipliers with ripple carry (=within rows) also skewed arrays of the type "McCanny & McWhirter" e.g. linear chain of cascaded adders	G06F 7/5306
With column-wise addition of partial products, e.g. using Wallace tree, Dadda counters (G06F 7/5324 takes precedence) e.g. adder trees	G06F 7/5318
Partitioned, i.e. using repetitively a smaller parallel-parallel multiplier or using an array of such smaller multipliers each smaller multiplier larger than 1 bit; multiprecision; also array multipliers A) $n \times m$ bit multiplier consisting of an array of $k \times l$ multipliers, k being a submultiple of n and l being a submultiple of m respectively, followed by an array or tree of adders, e.g. of Wallace type. B) $n \times m$ bit multiplication realised by a single $k \times l$ multiplier, k and l as above, used repetitively and followed by an accumulator. The $k \times l$ bit multipliers may be single ROM's for example. Not to be confused with multi-bit-scanning, where a selection among precalculated multiples of the multiplicand is made; if the $k \times l$ bit multipliers itself are of the latter type, double classification may be appropriate.	G06F 7/5324
Reduction of the number of iteration steps or stages, e.g. using the Booth algorithm, log-sum, odd-even for Booth, use the subgroups! Note: the term "Booth" is often incorrectly used when intending to say "modified Booth". A Booth recoder module inputs some, e.g. two, consecutive bits and sends a 'Booth carry' to a more significant module. A modified Booth recoder module inputs some, at least three, consecutive bits, the most significant of which is also input to the next higher recoder module. In modified Booth the recoder modules are not connected to each other via a carry.	G06F 7/533
By skipping over strings of zeroes or ones, e.g. using the Booth Algorithm e.g. using operand processing, e.g. simple (radix-2, 1st order) Booth, also canonical recoding to NAF form (sequential recoding with carry)	G06F 7/5332

By using multiple-bit-scanning, i.e. by decoding groups of successive multiplier bits in order to select an appropriate pre-calculated multiple of the multiplicand as a partial product i.e. processing multiple bits per iteration (radix > 2) without overlap, e.g. using positive precalculated multiples only groups of MR-bits are decoded for selecting multiples of MD e.g. 2-bit groups: 3-bit groups: 00 0 × MD 000 0 × MD 01 1 × MD 001 1 × MD 10 2 × MD 010 2 × MD 11 3 × MD 011 3 × MD 100 4 × MD 101 5 × MD 110 6 × MD 111 7 × MD Multiples, that are not a power of 2 (3x, 7x, etc) have to be precalculated or looked up in a table.	G06F 7/5334
Each bitgroup having two new bits, e.g. 2nd order MBA i.e. radix-4 modified Booth, i.e. 2nd order modified Booth	G06F 7/5338
Reduction of the number of iteration steps or stages, e.g. using the Sweeney-Robertson-Tocher (SRT) algorithm (not used, see G06F 7/535 or G06F 7/5375) NOT USED, non-restoring in general gets the KW non-restoring, SRT in particular goes in G06F 7/5375	G06F 7/537
Non restoring calculation, where each digit is either negative, zero or positive, e.g. SRT; (WARNING Not complete. Provisionally see G06F 7/535 + G06F 7/5375) almost empty - everything is in Indexing Code G06F 7/5375	G06F 7/5375
For evaluating functions by calculation (with a look-up table G06F 17/10 ; complex mathematical operations G06F 17/10 ; G06F 7/4806 , G06F 7/4824 take precedence) e.g. min, max of two operands, absolute value, (sum of) absolute difference finding a maximum value of a set (e.g. during sorting) is in G06F 7/22 ; direct table lookup of function values is in G06F 1/03 ; table lookup of coefficients during computation goes here, put "table lookup" in the TXT field;	G06F 7/544
Sum of products (for applications thereof, see the relevant places, e.g. G06F 17/10 , H03H 17/00) e.g. MACs; fused multiply add (FMA) for floating point are in G06F 7/483 with G06F 7/5443	G06F 7/5443
using crossaddition algorithms, e.g. CORDIC e.g. sin, cos, tan, sinh, cosh, tanh; CORDIC on complex numbers: G06F 7/4818	G06F 7/5446
Powers or roots, e.g. Pythagorean sum e.g. powers by multiplying the operand by itself (which is not possible with non-integer powers)	G06F 7/552

Arithmetic logic units (ALU), i.e. arrangements or devices for performing two or more of the operations covered by groups G06F 7/483 - G06F 7/556 or for performing logical operations (instruction execution G06F 9/30 ; G06F 7/49 , G06F 7/491 take precedence; logic gate circuits H03K 19/00)e.g. arrangements for performing more than one operation using the same circuitry	G06F 7/57
Basic arithmetic logic units, i.e. devices selectable to perform either addition, subtraction or one of several logical operations, using, at least partially, the same circuitry: Note: multiplication is not seen as "basic"	G06F 7/575

G06F 7/60

Methods or arrangements for performing computations using a digital non-denominational number representation, i.e. number representation without radix; Computing devices using combinations of denominational and non-denominational quantity representations, {e.g. using difunction pulse trains, STEELE computers, phase computers (conversion of digital data to or from non-denominational form [H03M 5/00](#), [H03M 7/00](#))}

Definition statement

This subgroup covers:

For example, documents concerning

- "permutograph";
- a "Negationsnetz";

Fibonacci code representation. Further details of subgroups

[G06F 7/602](#):

[N: using difunction pulse trains (STEELE computers); phase computers (GAINES)]. e.g. Delta-Sigma sequences.

[G06F 7/607](#):

[N: number-of-ones counters, i.e. devices for counting the number of input lines set to ONE among a plurality of input lines, also called bit counters or parallel counters (for applications thereof, see the relevant places, e.g. [G06F 7/49](#), [G06F 7/5013](#), [G06F 7/509](#), [H03M 1/00](#), [H03M 7/20](#))]

e.g. number of ones counters (parallel counters), compressors, carry save adders 4-2, 7-3, etc, e.g. used in multipliers.

[G06F 7/64:](#)

Digital differential analysers, i.e. computing devices for differentiation, integration or solving differential or integral equations, using pulses representing increments; Other incremental computing devices for solving difference equations ([G06F 7/70](#) takes precedence; differential analysers using hybrid computing techniques [G06J 1/02](#)) [N: DDA application in numerical control [G05B 19/18](#)]. Integration per se: [G06F 17/10](#).

[G06F 7/68:](#)

Using pulse rate multipliers or dividers [N: pulse rate multipliers or dividers per se] ([G06F 7/70](#) takes precedence) [N: (frequency division in electronic watches [G04G 3/02](#); frequency multiplication or division in oscillators [H03B 19/00](#); frequency dividing counters per se [H03K 23/00](#) to [H03K 29/00](#))]

e.g. phased locked loop (PLL) with digital divider (thus achieving pulse rate multiplication); PLLs in general are in [H03L 7/06](#);

pulse rate doubling by adding delayed pulses and correcting the duty cycle are in [H03K 5/1565](#); [H03K 23/00](#) to [H03K 29/00](#) mostly relate to analogue aspects.

References relevant to classification in this group

This subgroup does not cover:

Conversion of digital data to or from non-denominational form	H03M 5/00 , H03M 7/00
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G06F 7/72

using residue arithmetic

Definition statement

This subgroup covers:

A mod N, modulo addition, modulo subtraction

[G06E 1/065](#): optical residue arithmetic devices

applications in:

[H03M 13/00](#), Error detection/correction for coding in general.

[G06F 11/00](#), Error detection/correction in computers.

[H04L 1/00](#), Error detection/correction in transmission.

[H04L 9/00](#), Secret communication. Further details of groups

[G06F 7/721:](#)

Modular inversion, reciprocal or quotient calculation ([G06F 7/724](#), [G06F 7/727](#), [G06F 7/728](#) take precedence).

e.g. modular division; both with composite moduli and in prime number fields; inversion in extension fields is in [G06F 7/726](#).

[G06F 7/723:](#)

[N: Modular exponentiation ([G06F 7/724](#), [G06F 7/727](#), [G06F 7/728](#) take precedence)] [N0302] [C0302]. RSA in general is here.

[G06F 7/724:](#)

Finite field arithmetic (for error detection or correction in general [H03M 13/00](#), in computers [G06F 11/10](#)).

Mainly (binary) extension fields; prime number fields using modular arithmetic and are in [G06F 7/72](#) to [G06F 7/723](#), [G06F 7/727](#) and [G06F 7/728](#).

For this type of arithmetic also the term "Galois field" and symbols of the type GF (2P) are characteristic.

[G06F 7/725:](#)

over elliptic curves

elliptic curve cryptography ECC goes here, but only give class if specific adaptation for ECs.

[G06F 7/726:](#)

[N: Inversion; Reciprocal calculation; Division of elements of a finite field] E.g. rational functions $p(x)/q(x)$.

[G06F 7/728](#)

Using Montgomery reduction

Montgomery reduction involves adding of multiples of the modulo, followed by right shifting.

[G06F 7/729](#)

using representation by a residue number system

e.g. Chinese Remainder Theorem for non-RSA

A residue number system (RNS) is a system in which a number is represented by a series of digits, each of which is the remainder of that number with respect to a different modulus m_i :

e.g.: moduli $\rightarrow 5\ 3\ 2$

$26_{10} = 1\ 2\ 0$

The maximum number representable is $M = (\prod_i m_i) - 1$

e.g.: $(2 \times 3 \times 5) - 1 = 29$ in the above case.

G06F 7/74

Selecting or encoding within a word the position of one or more bits having a specified value, e.g. most or least significant one or zero detection, priority encoders {(with shifting [G06F 5/01](#))}

Definition statement

This subgroup covers:

E.g. leading zero anticipation LZA, priority encoders.

With shifting (during/for detection) details: also in [G06F 5/01](#).

References relevant to classification in this group

This subgroup does not cover:

with shifting	G06F 5/01
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G06F 7/76

Arrangements for rearranging, permuting or selecting data according to predetermined rules, independently of the content of the data (according to the content of the data [G06F 7/06](#), [G06F 7/22](#); parallel / series conversion or vice versa [H03M 9/00](#))

Definition statement

This subgroup covers:

For example, masking, shuffling

[G06F 7/764](#): Masking. Boolean masking in block or stream ciphers in [H04L 9/0612](#).

[G06F 7/766](#): Generation of all possible permutations. i.e. serial or parallel generation of all permutations.

[G06F 7/768](#): Data position reversal, e.g. bit reversal, byte swapping

e.g. endian conversion;

Endian conversion by memory addressing: [G06F 12/04](#).

Bus coupling with endian conversion: [G06F 13/4013](#).

Endian conversion instruction: [G06F 13/4013](#) .

References relevant to classification in this group

This subgroup does not cover:

Arrangements for rearranging, permuting or selecting data according to the content of the data	G06F 7/06 , G06F 7/22
Parallel / series conversion or vice versa	H03M 9/00

G06F 7/78

for changing the order of data flow, e.g. matrix transposition, LIFO buffers; Overflow or underflow handling therefor

Definition statement

This subgroup covers:

LIFO, also called stack or pushdown store:

- Reversal of a train of data words.
- Reversal of a train of data bits.

Devices called FIFO, but having possibilities to extract also other data items than the first one.

Matrix transportation devices.

Other devices with an output sequence different from the input sequence, but independent of the contents of the data.

References relevant to classification in this group

This subgroup does not cover:

FIFO-devices:	G06F 5/06
cache-memories:	G06F 12/08
"FIFO" with priority-controlled output:	G06F 13/18
reordering based on contents of data, e.g. sort key:	G06F 7/22

G06F 8/00

{Arrangements for software engineering (execution of stored program [G06F 9/06](#); testing or debugging [G06F 11/36](#); hardware/software co-design [G06F 17/50](#); software project management [G06Q 10/06](#))}

Definition statement

This group covers:

The engineering discipline of creating software and the assistance of computer tools (CASE tools) in exercising the task of software engineering.

The phases covered by [G06F 8/00](#) range from the initial requirements collection up to and including the delivery of software to the end user (excluding the phase of testing and debugging).

References relevant to classification in this group

This group does not cover:

Hardware/software co-design	G06F 17/50
Testing or debugging	G06F 11/36
Software project management	G06Q 10/06
Execution of a stored program	G06F 9/06

Synonyms and Keywords

In patent documents the following abbreviations are often used:

CASE	Computer-Aided Software Engineering
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G06F 8/10

{Requirements analysis; Specification techniques}

Definition statement

This subgroup covers:

Capturing user requirements into a more formalised form:

- Graph notations;
- Diagramming techniques, e.g. Dataflow diagrams;
- Requirements specifications;
- Use of modelling languages such as uml;
- Petri nets.

References relevant to classification in this group

This subgroup does not cover:

Specification of network protocols	H04L 69/03
Circuit design	G06F 17/5045

Synonyms and Keywords

In patent documents the following abbreviations are often used

UML	Unified Modeling Language
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G06F 8/20

{Software design}

Definition statement

This subgroup covers:

Determining the design of software, e.g. the modules that will be created, the main structure of each of these modules and the relationships between them.

References relevant to classification in this group

This subgroup does not cover:

For Physical Process Control Systems (FR2898698, US5247693)	G05B 19/00
Web development (US2006020908)	G06F 17/30861
Multimedia authoring	G11B 27/031
Software development for telecom switching systems	H04Q 3/54583

Synonyms and Keywords

In patent documents the following abbreviations are often used:

MVC	Model-View-Controller
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G06F 8/22**{Procedural}****Definition statement***This subgroup covers:*

The conventional design paradigm, where a design is defined in terms of a sequence of actions to be performed. An example is the Jackson Structured Programming method.

References relevant to classification in this subclass/group*This subgroup does not cover:*

Procedure invocation and execution	G06F9/40
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Informative references*Attention is drawn to the following places, which may be of interest for search:*

Declarative	G06F 8/313
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G06F 8/24**{Object oriented}****Definition statement***This subgroup covers:*

The process of planning a system in terms of interacting objects for the purpose of solving a software problem as defined by the (formalised) user requirements. Examples are the design patterns from the book "Design Patterns: Elements of Reusable Object-Oriented Software" by Gamma et al.

Informative references*Attention is drawn to the following places, which may be of interest for search:*

Object-oriented method resolution	G06F 9/443
Inheritance	G06F 9/4433
Object-oriented systems	G06F 9/4433
Object-oriented databases	G06F 17/30607

G06F 8/30

{Creation or generation of source code}

Definition statement

This subgroup covers:

The conceptual step of converting an abstract representation (design or specification) of a software system, into a more concrete representation in the form of program code.

References relevant to classification in this group

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Porting source code to a different environment	G06F 8/76
Optimisation of source code	G06F 8/443
Preprocessors	G06F 8/423
Source to source translation	G06F 8/51

Informative references

Attention is drawn to the following places, which may be of interest for search:

Reverse engineering; Extracting design information from a source code	G06F 8/74
Query generation	G06F 17/30634 , G06F 17/30386
Compilation, i.e. transforming HLL source code into machine code	G06F 8/41
Specification techniques for generating programs	G06F 8/10

G06F 8/31

{Programming languages or programming paradigms}

Definition statement

This subgroup covers:

Programming languages and paradigms that can be used by a programmer in order to create source code.

References relevant to classification in this group

This subgroup does not cover:

Processing or translating of natural language	G06F 17/28
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Synonyms and Keywords

In patent documents the following abbreviations are often used:

HLL	High Level Language
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G06F 8/311

{Functional or applicative languages; Rewrite languages}

Definition statement

This subgroup covers:

Languages designed for functional programming that treats computation as the evaluation of mathematical functions. Examples are Sasl, Miranda and Haskell.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Functional programming	software development model which expresses algorithms as functions, i.e. as stateless mappings of input values to output values
Declarative programming	programming paradigm that expresses a computation without describing its control flow

G06F 8/312

{List processing, e.g. LISP programming language}

Definition statement

This subgroup covers:

List processing languages, e.g. Lisp and Scheme.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

CAR	Function that determines the first element of a list
CDR	Function that determines the list after its first element

G06F 8/313

{Logic programming, e.g. PROLOG programming language}

Definition statement

This subgroup covers:

Programming languages expressing a program as a collection of logical statements.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Declarative programming	programming paradigm that expresses a computation without describing its control flow
Horn clause	logical statement

G06F 8/3135

{Unification or backtracking}

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Unification	finding an assignment that satisfies all clauses
Backtracking	done on partial unifications that cannot succeed, and to continue to find more possible unifications

G06F 8/314

{Parallel programming languages ([G06F 8/313](#) takes precedence)}

Definition statement

This subgroup covers:

Programming languages having constructs for expressing parallelism, e.g. Occam.

References relevant to classification in this group

This subgroup does not cover:

Parallel logic programming	G06F 8/313
Detecting and extracting parallelism from program code	G06F 8/456

G06F 8/315

{Object-oriented languages}

Definition statement

This subgroup covers:

Programming languages expressing algorithms as interacting objects, where an object is an aggregation of data (attributes) and actions (methods).

Examples of object oriented languages are Smalltalk, Ruby, Eiffel, C++, C#, Java, Oberon, Modula.

References relevant to classification in this group

This subgroup does not cover:

Method invocation	G06F 9/443
Object-oriented systems	G06F 9/4428
Distributed object-oriented systems	G06F 9/465
Object-oriented databases	G06F 17/30607
Object-oriented design paradigms	G06F 8/24

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Method	the action to be performed on (attributes of) an object
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G06F 8/316

{Aspect-oriented programming techniques}

Definition statement

This subgroup covers:

Programming paradigm allowing different, orthogonal, aspects of a program (business rules, security, fault tolerance, data consistency) to be designed independently and to be merged later to produce a final source code product.

Aspect-Oriented Software Development foresees a full and independent design for all the secondary aspects of an application like security, persistency, synchronization, logging, etc., carried out at the same time as the design of the core functionality of the application.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Aspect Weaving	the process of merging the different aspects
Join Points	the actual places in the program where the aspects are merged

Synonyms and Keywords

In patent documents the following abbreviations are often used:

AOSD	Aspect oriented software development
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G06F 8/33

{Intelligent editors (text processing [G06F 17/21](#))}

Definition statement

This subgroup covers:

Intelligent editors that help a programmer to write programs, e.g. language-sensitive editors.

Examples:

- Proposing a closing bracket when an opening bracket is typed.
- Indenting of if-then-else statements.
- Verification of entered text (e.g. whether variables are already declared).

References relevant to classification in this group

This subgroup does not cover:

Text processing	G06F 17/21
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G06F 8/34

{Graphical or visual programming (use of icons for interaction with graphical user interfaces [G06F 3/048](#))}

Definition statement

This subgroup covers:

A programming technique whereby a program is created by handling graphical programming objects representing programming constructs/statements rather than writing program text.

References relevant to classification in this group

This subgroup does not cover:

Development of GUIs, User Interface Management Systems (UIMS)	G06F 8/38
Intelligent editors	G06F 8/33
Web page development	G06F 17/30861
Use of icons for interaction	G06F 3/048

Informative references

Attention is drawn to the following places, which may be of interest for search:

Creating relay ladder logic program for Programmable Logic controllers (PLC)	G05B 19/056
Creating programs for controlling physical processes by graphically specifying the process to be controlled	G05B 19/0426
Multimedia authoring	G11B 27/031

G06F 8/35

{Model driven}

Definition statement

This subgroup covers:

Automatically generating program code (source code) from a specification/definition/model of what the program should do.

Typical examples: WO0108007, WO02086704, EP0737918, WO0177882.

Specific topics included:

- Generating a debugger from a formal specification: EP1071016;
- Generation of source code for web applications: WO0171566;
- Convert spreadsheet data into source code: US2003106040, US2004064470;
- Generate source code from XML: US2003167444;
- Generate a shader program from a graphics file: US2003179220;
- OMG's Model driven architecture (MDA).

Synonyms and Keywords

In patent documents the following abbreviations are often used:

MDSD	Model driven software development
MDA	Model driven architecture

G06F 8/355

{Round-trip engineering}

Definition statement

This subgroup covers:

Arrangement for keeping a model and the corresponding program code in sync when applying changes to any of them.

G06F 8/36

{Software reuse}

Definition statement

This subgroup covers:

- Storing and retrieving reusable software modules into and from software repositories;

- Building, searching and maintaining software repositories containing reusable software parts;
- Managing repositories of software components, objects;
- Storing software components into a repository, thereby indicating additional information about the components, e.g. the function performed, what inputs are required, what outputs are generated;
- Querying the repository to retrieve components that satisfy the particular requirements, e.g. related to its function;
- Detecting program parts that are candidates for reuse;
- Design patterns.

References relevant to classification in this group

This subgroup does not cover:

Code clone detection, i.e. detection of identical pieces of code for the purpose of maintenance	G06F 8/751
Exlining, i.e. finding similar sequences of code to replace them with a procedure invocation	G06F 8/4436
Version control using repositories	G06F 8/71

Informative references

Attention is drawn to the following places, which may be of interest for search:

Plagiarism detection in program code	G06F 21/10
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G06F 8/37

{Compiler construction; Parser generation}

Definition statement

This subgroup covers:

Automatically generating a compiler or parser based on a specification of a grammar/syntax, e.g. Lex and Yacc.

Also includes generation of lexical analyzers see XP000095042.

References relevant to classification in this group

This subgroup does not cover:

Compilation per se	G06F 8/41
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Compiler Bootstrapping	creating a compiler using the language it is intended to compile
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G06F 8/38

{Implementation of user interfaces (interaction techniques for graphical user interfaces [G06F 3/048](#))}

Definition statement

This subgroup covers:

Development and generation of user interfaces, in particular GUI.

References relevant to classification in this group

This subgroup does not cover:

Details relating to the actual functioning of (graphical) user interfaces	G06F 9/4443
All other aspects relating to user interaction with graphical user interfaces	G06F 3/048

G06F 8/40

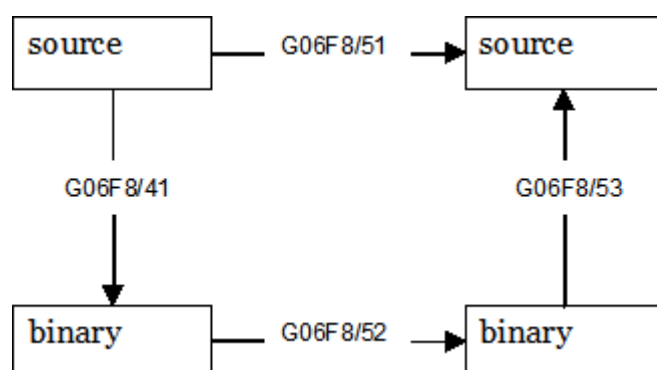
{Transformations of program code}

Definition statement

This subgroup covers:

The transformation of program code from one form into another.

The direct subclasses of [G06F 8/40](#) cover all possible combinations involving source code and binary code.



References relevant to classification in this group

This subgroup does not cover:

Transformation of XML code into markup languages	G06F 17/20
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G06F 8/41

{Compilation}

Definition statement

This subgroup covers:

The process of converting program code, written in a high level programming language, into binary code.

Conceptually, a general compiler consists of three main parts:

- Front end - checks whether the program is correctly written in terms of the programming language syntax and semantics. The output of this part is an intermediate representation of the source code being further processed by the middle-end;
- Middle part - optimizes the intermediate representation and generates another intermediate representation for processing by the back-end;
- Back end - translates the intermediate representation from the middle-part into an assembly code.

References relevant to classification in this group

This subgroup does not cover:

Compiler generators	G06F 8/37
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Binary code	a representation of a code understood by a machine
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G06F 8/42

{Syntactic analysis}

Definition statement

This subgroup covers:

Determining grammatical structure of the source code with respect to a given formal grammar.

G06F 8/423

{Preprocessors}

Definition statement

This subgroup covers:

Processing language-external elements, e.g. compiler directives, macro definitions and macro expansions, and inclusion of library source files.

G06F 8/425

{Lexical analysis}

Definition statement

This subgroup covers:

Converting sequences of characters into tokens, skipping comments.

G06F 8/427

{Parsing}

Definition statement

This subgroup covers:

Checking for correct syntax and building a data structure, e.g. parse tree.

Multibox parsers.

References relevant to classification in this subclass/group

This subgroup does not cover:

Parser generators	G06F 8/37
Parsing of XML code	G06F 17/20

G06F 8/43

{Checking; Contextual analysis}

Definition statement

This subgroup covers:

Checking context-sensitive conditions, e.g. whether variables have been declared.

G06F 8/433

{Dependency analysis; Data or control flow analysis}

Definition statement

This subgroup covers:

Determining the dependencies between different program parts (e.g. data dependencies, which variables/values are used in expressions, and control dependencies, which statements have influence on other statements), in particular to determine whether such program parts should be placed in a certain order.

G06F 8/434

{Pointers; Aliasing}

Definition statement

This subgroup covers:

Determining whether references, e.g. pointers, reference variables and indexed array elements, actually refer to the same underlying memory element.

G06F 8/436

{Semantic checking}

Definition statement

This subgroup covers:

Checking semantic conditions which can be determined without actual execution of the program, e.g. whether variables are initialized.

G06F 8/437

{Type checking}

Definition statement

This subgroup covers:

Checking type compatibility of values, variables, parameters and expressions.

G06F 8/44

{Encoding}

Definition statement

This subgroup covers:

Generating an executable implementation of the program for the target machine architecture, usually via an internal form that is independent of the source programming language and that is also independent of the target machine architecture.

G06F 8/441

{Register allocation; Assignment of physical memory space to logical memory space}

Definition statement

This subgroup covers:

Assigning logical registers to variables, assigning physical register to logical registers, coalescing, spilling.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Coalescing	removing useless copy instructions from a program. This needs information about assigned registers and therefore it is commonly performed as a subtask of register allocation besides spilling and register assignment.
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G06F 8/443

{Optimisation}

Definition statement

This subgroup covers:

Optimisation of the program code; the program code can take any form e.g. source code, assembly code, machine code.

References relevant to classification in this group

This subgroup does not cover:

Code refactoring	G06F 8/72
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Special rules of classification within this group

Whenever an optimisation concerns speed, size, etc, such documents should be classified in the corresponding subgroups. In this group should be classified only special optimisation techniques not present in any of the subgroups.

Contains optimizations that do not involve a trade off between different factors (speed, size, energy consumption)	G06F 8/443
Involve a trade-off. They are specifically aimed to optimize one aspect, likely at the cost of another aspect.	G06F 8/4432 , G06F 8/4434 , G06F 8/4441

G06F 8/4432

{Reducing the energy consumption}

Definition statement

This subgroup covers:

Optimisation methods specifically aimed at reducing the energy consumption of program code.

References relevant to classification in this group

This subgroup does not cover:

Means for Saving Power, Power Management strategies	G06F 1/3203
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G06F 8/4434

{Reducing the memory space required by the program code (digital compression [H03M 7/30](#))}

Definition statement

This subgroup covers:

Optimisation methods specifically aimed at reducing the size of the program code, e.g. by replacing sequences of recurring instructions with a new macro instruction/superinstruction. Requires that the target architecture/virtual machine recognize this new instruction; Cross jumping; Tail Merging.

References relevant to classification in this group

This subgroup does not cover:

Data compression (e.g. PKZIP)	H03M 7/30
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Special rules of classification within this group

Note that this class does not deal with compression of program code, which requires a decompression before it can be executed. Compression of program code in this sense does not result in the actual program being smaller; there is only a saving in the secondary storage or transmission via the network.

In contrast, the size-reduced code resulting from the this class is directly executable, so no decompression is needed before execution.

G06F 8/4435

{Detection or removal of dead or redundant code}

Definition statement

This subgroup covers:

Detecting and removing of dead or redundant code. Redundancy elimination optimizations avoid repeated computation of the same value by computing the value once, saving it in a temporary variable, and reusing the value from the temporary variable when it is needed again. Examples of redundancy elimination optimizations include common subexpression elimination, loop invariant code motion and partial redundancy elimination.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Dead code	code that is never executed or that is unreachable.
Redundant code	code that produces results that are never used or are irrelevant to the program execution or code that computes values that were already computed before.

G06F 8/4436

{Exlining; Procedural abstraction}

Definition statement

This subgroup covers:

Detecting recurring sequences of instructions and replacing each of them with a call to a procedure/function that contains those instructions.

References relevant to classification in this group

This subgroup does not cover:

Inlining	G06F 8/4443
Code clone detection, i.e. detection of identical pieces of code for the purpose of maintenance	G06F 8/751
Reuse, i.e. identifying recurring pieces of code for purposes of reuse	G06F 8/36
Plagiarism detection in a source code	G06F 21/10

G06F 8/4441

{Reducing the execution time required by the program code}

Definition statement

This subgroup covers:

Optimisation methods specifically aimed at improving the execution speed of the program.

G06F 8/4442

{Reducing the number of cache misses; Data prefetching (cache prefetching [G06F 12/0862](#))}

Definition statement

This subgroup covers:

Avoiding cache misses at run-time. Cache can be instruction or data cache.

Splitting a program into frequently used and not frequently used parts (hot and cold parts) and keeping the hot parts in the cache.

Rearranging the individual instructions in order to have data/instructions present in the cache when they are needed.

References relevant to classification in this group

This subgroup does not cover:

Cache prefetching	G06F 12/0862
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G06F 8/4443

{Inlining}

Definition statement

This subgroup covers:

Replacing a procedure invocation with the instructions of the procedure, thus removing the cost of procedure invocation.

References relevant to classification in this group

This subgroup does not cover:

Exlining	G06F 8/4436
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G06F 8/445

{Exploiting fine grain parallelism, i.e. parallelism at instruction level (run-time instruction scheduling [G06F 9/3836](#))}

Definition statement

This subgroup covers:

Increasing the Instruction Level Parallelism (ILP) that can be exploited by the hardware at run-time (pipelines, superscalar processors executing multiple instruction streams). Typically this is done by reordering the instructions (scheduling).

References relevant to classification in this group

This subgroup does not cover:

Exploiting coarse grain parallelism	G06F 8/45
Run-time scheduling or reordering of instructions by the hardware	G06F 9/3836
Process scheduling	G06F 9/4881

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Scheduling	reordering of instructions
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Synonyms and Keywords

In patent documents the following abbreviations are often used:

ILP	Instruction Level Parallelism
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G06F 8/4451

{Avoiding pipeline stalls}

Definition statement

This subgroup covers:

Reducing or avoiding run-time pipeline stalls.

Pipeline stalls (or bubbles) are caused by control hazards – e.g. branches -, data hazards -one instruction depends on the result of another instruction and must wait for this instruction to finish- or resource hazards -there are not

enough resources to serve all the instructions currently in flight - instructions must wait for resources to be freed in order to be fed to the pipeline. Control Hazards can be handled by static branch-prediction, speculative execution or delayed branch. Data Hazards can be avoided by rearranging the instructions so that instructions that depend on each other's result are farther separated.

In a pipeline, there is only one instruction stream. So the parallelism consists in the overlapping of the instructions of the stream rather than executing the instructions of 2 streams simultaneously.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Hardware aspects of pipelining	G06F 9/38
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G06F 8/4452

{Software pipelining}

Definition statement

This subgroup covers:

Software pipelining, e.g. Modulo Scheduling, transforms a loop described in a high-level programming language, such as C or FORTRAN, in such a way that the execution of successive iterations of the loop are overlapped rather than sequential. This technique exposes the instruction level parallelism (ILP) available between successive loop iterations to the compiler and to the processor executing the transformed code.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Hardware aspects of pipelining	G06F 9/38
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G06F 8/447

{Target code generation}

Definition statement

This subgroup covers:

Generation of executable code from the optimized compiler-internal representation of the source code, taking the target machine architecture into account.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Run-time compounding of instructions by the hardware	G06F 9/3853
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G06F 8/45

{Exploiting coarse grain parallelism in compilation, i.e. parallelism between groups of instructions}

Definition statement

This subgroup covers:

Speeding up the execution of a single task by subdividing the task into a plurality of subtasks and having the subtasks executed simultaneously on different processors. The subtasks are interdependent and they work together to achieve the same goal as the original task.

References relevant to classification in this group

This subgroup does not cover:

Exploiting fine grain parallelism	G06F 8/445
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G06F 8/451

{Code distribution (considering CPU load at run-time [G06F 9/505](#); load rebalancing [G06F 9/5083](#))}

Definition statement

This subgroup covers:

Distributing the code of each of the subtasks to the available processors.

References relevant to classification in this group

This subgroup does not cover:

Considering CPU load at run-time	G06F 9/505
Load rebalancing	G06F 9/5083

G06F 8/452**{Loops}****Definition statement***This subgroup covers:*

Distributing iterations of parallelizable loops among the processors.

References relevant to classification in this group*This subgroup does not cover:*

Allocation of resources to service a request	G06F 9/5005
Techniques for rebalancing the load in a distributed system at run-time	G06F 9/5083
Software pipelining	G06F 8/4452

G06F 8/453**{Data distribution}****Definition statement***This subgroup covers:*

Dividing the data used by the subtasks over the different processors.

G06F 8/454**{Consistency (cache consistency protocols in hierarchically structured memory systems [G06F 12/0815](#))}****Definition statement***This subgroup covers:*

Ensuring data consistency between subtasks.

References relevant to classification in this group*This subgroup does not cover:*

Cache consistency protocols in hierarchically structured memory systems	G06F 12/0815
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G06F 8/456

{Parallelism detection}

Definition statement

This subgroup covers:

Detecting parallelism in sequential programs, e.g. by making use of control flow and data flow information.

In this class the burden to detect and extract parallelism is put on the compiler or another software tool. This contrasts with the [G06F 8/314](#), where the burden of indicating parallelism is put on the programmer.

References relevant to classification in this group

This subgroup does not cover:

Techniques and language constructs to create parallel programs	G06F 8/314
Data flow analysis, control flow analysis	G06F 8/433

G06F 8/457

{Communication (intertask communication [G06F 9/54](#))}

Definition statement

This subgroup covers:

Communication between subtasks, allowing the generated tasks to interact with each other, for example to pass parameters or to return results.

References relevant to classification in this group

This subgroup does not cover:

Communication between independent tasks	G06F 9/54
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G06F 8/458

{Synchronisation, e.g. post-wait, barriers, locks (synchronisation among tasks [G06F 9/52](#))}

Definition statement

This subgroup covers:

Synchronisation between subtasks.

References relevant to classification in this group

This subgroup does not cover:

Synchronisation between independent tasks	G06F 9/52
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G06F 8/47

{Retargetable compilers}

Definition statement

This subgroup covers:

Compiler structure allowing for several source languages (multiple front ends) and/or several target machine architectures (multiple back ends). Some examples of techniques and compilers for this are:

- Architecture Neutral Data Format (ANDF);
- UCSD Pascal P-code;
- Universal Compiler Language (UNCOL);
- GCC - GNU Compiler Collection.

References relevant to classification in this subclass/group

This subgroup does not cover:

Generating code for just one computing platform	G06F 8/447
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Retargetable compiler	a compiler that can relatively easily be modified to generate code for different CPU architectures.
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G06F 8/48

{Incremental compilation (software reuse [G06F 8/36](#))}

Definition statement

This subgroup covers:

Recompiling only those parts of source code that are affected by a modification.

References relevant to classification in this group

This subgroup does not cover:

Software reuse	G06F 8/36
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G06F 8/49

{Partial evaluation}

Definition statement

This subgroup covers:

Specializing a program for some or all of its possible input values.

Different flavours are:

- “normal” PE (partial evaluation): specialize program for certain values of its inputs
- “predictive” PE: predict the run-time values of some inputs and specialize the program accordingly. At run-time, check if the prediction was correct. If yes, execute it. If no, recompile using the actual values.
- “multi-version” PE: generate multiple specialized versions of the program corresponding to different inputs. At run-time choose the appropriate version.
- “placeholder” PE: specialize the program for the known inputs. For the unknown inputs, provide placeholders, that will be filled in at run-time.

References relevant to classification in this group

This subgroup does not cover:

Optimizing a method invocation based on the type of the receiving object	G06F 9/4431
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G06F 8/51

{Source to source}

Definition statement

This subgroup covers:

Translating program code from a first high level programming language to a different second high-level programming language (e.g. from Java to C++). This transformation is independent of the target processor.

References relevant to classification in this group

This subgroup does not cover:

Binary to binary translation	G06F 8/52
Source to binary translation	G06F 8/41
Porting; modifying the source code of the application in order to adapt it to new / changed requirements	G06F 8/76
Porting source code to a different environment	G06F 8/76
Optimisation of source code	G06F 8/443
Preprocessors	G06F 8/423

G06F 8/52

{Binary to binary}

Definition statement

This subgroup covers:

Static translation (i.e. pre-run-time) of binary code from one architecture to a different architecture.

The class deals with the following forms of static binary code translation:

Binary to binary

Intermediate bytecode to another intermediate bytecode (e.g. Java bytecode, p-code)

References relevant to classification in this group

This subgroup does not cover:

Source to source translation	G06F 8/51
Binary to source translation	G06F 8/53

G06F 8/53

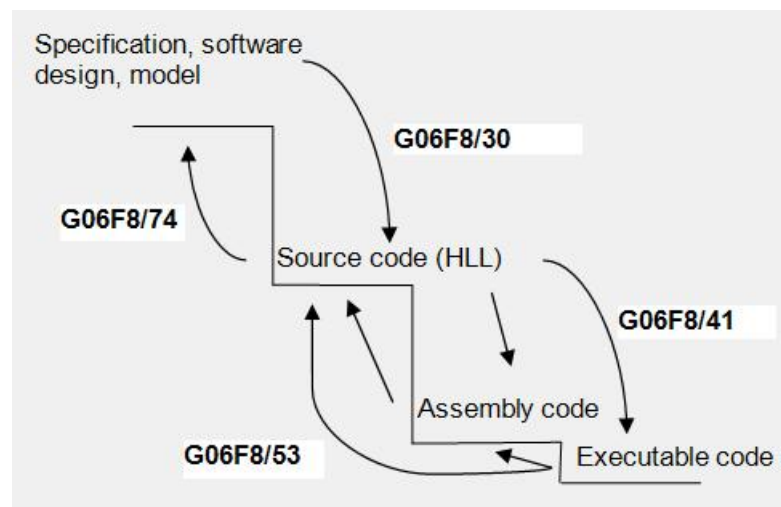
{Decompilation; Disassembly}

Definition statement

This subgroup covers:

Transformation of executable code into source code or assembly code.

Relationship between large subject matter areas



References relevant to classification in this group

This subgroup does not cover:

Reverse engineering	G06F 8/74
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Protecting software against software analysis or reverse engineering, e.g. by code obfuscation	G06F 21/12
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G06F 8/54

{Link editing before load time (link editing at or after load time [G06F 9/44521](#))}

Definition statement

This subgroup covers:

Statically linking modules before load-time in order to create executable binary code.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Dynamic linking, i.e. linking at or after load time, during run-time	G06F 9/44521
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G06F 8/60

{Software deployment}

Definition statement

This subgroup covers:

Installation and updating of computer software.

This group includes methods that make the installation/update of software program transparent, automatic and user-friendly, both to the end-user and the network administrator. It responds to the need, when installing/updating software, to automate the process of deciding which programs have to be updated, when this must happen, with what they must be updated, where old and new programs are located, this doing away with the need for both user/network manager to make those decisions "manually".

Includes:

updating or installing software based on physical location of the target device (US2007/0226343, US2010/0169200, US2006/0101449, US7206828, US2005/0222918).

References relevant to classification in this group

This subgroup does not cover:

Installation or update in a secure manner	G06F 21/57
Installation or update in a fault tolerant manner	G06F 11/1433

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Software downloading in telecom switches	H04Q 3/54516
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Fault tolerant update or installation. For example when an error occurs during software upgrade, the system is rebooted and restored to the state before installation.	G06F 11/1433
Secure installation and upgrading; licensing; Try and buy software	G06F 21/70 , G06F 21/57 , G06F 21/10
Installation and upgrade of device drivers	G06F 9/4411

Network booting	G06F 9/4416
Download/install/upgrade software in mobile communication devices	H04M 1/72525
Updating, downloading of parameters to a mobile device	H04Q7/321
Multimedia set-top boxes under program control	H04N 5/4403
Updating of system parameters into mobile communication devices	H04Q7/321
Downloading information (also software) into vehicles	G07C 5/008
Personalization of smart card applications	G07F 7/10
Medical devices, equipment management, e.g. update, maintenance	G06F 19/00
Arrangements in connection with the implantation of stimulators; Changing the program; Upgrading firmware	A61N 1/37264

Special rules of classification within this group

Installation/update wizards that assist a user in installing/updating software, are also classified in [G06F 9/4446](#) (Help systems).

G06F 8/61

{Installation}

Definition statement

This subgroup covers:

First-time installation of software.

Unattended installation, installation scripts (answer file)

Network installation.

Installation packages (containing list of files, program image, files itself, install/update instructions).

Network installation plans.

Type of installations.

Silent installation - no display of the progress of the installation

Unattended installation - installation performed without user interaction

Self installation - unattended installation without the need of initial launch of the process.

Headless installation - installation performed without using a monitor connected to the destination computer.

Clean installation - cleaning up a destination partition (formatting) before actual installation.

Flat installation - first copying installation files from a media to a hard disk and then installing them from the hard drive.

Network installation - installation of a program from a shared network drive

Virtual installation - performing a virtual installation to check for errors before committing the real installation.

References relevant to classification in this group

This subgroup does not cover:

Network booting	G06F 9/4416
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Installation	setup, deployment
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G06F 8/62

{Uninstallation}

Definition statement

This subgroup covers:

Removing software and all its related components.

Uninstallation of software i.e. removing software and all its related components, without interfering with the operation of other software;

Undoing installations/update.

Rollback, reverting to a previous installation/update status. Requires the use of some kind of log file.

References relevant to classification in this group

This subgroup does not cover:

Unloading program code from executable memory	G06F 9/445
Garbage collection	G06F 12/0253

G06F 8/63

{Image based installation; Cloning; Build to order}

Definition statement

This subgroup covers:

Installation of whole systems by copying disk images to target systems,

Cloning installed systems.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Software billing	G06Q 30/00
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Synonyms and Keywords

In patent documents the following abbreviations are often used:

BTO	Build to order
MTO	Make to order

G06F 8/64

{Retargetable}

Definition statement

This subgroup covers:

Installation or update explicitly taking into account hardware characteristics of the target.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Retargetable compilation	G06F 8/47
Retargetable program loading	G06F 9/44542

G06F 8/65

{Update}

Definition statement

This subgroup covers:

Updating of existing software, i.e. modifying already installed software to a desired version.

Being informed of new software that has become available in order to update, install;

Synchronization of software of disconnectable devices after their reconnection to the network automatically upgrading software to the correct version.

Transparent update (e.g. after boot, after update becomes available, regular check for updates,...)

User-initiated update or installation.

References relevant to classification in this group

This subgroup does not cover:

Synchronizing caches	G06F 12/00
Replication of documents/files	G06F 17/30

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

For set top boxes	H04N 5/4403 H04N 21/4586
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G06F 8/66

{of program stored in read-only memory [ROM]}

Definition statement

This subgroup covers:

Updating software that is stored in non-alterable ROM.

G06F 8/665

{of program code stored in alterable solid state memory, e.g. EEPROM, flash}

Definition statement

This subgroup covers:

Updating software stored in non-volatile, alterable, solid-state storage, e.g. flash, EEPROM.

Includes:

A specific technique relevant to this class is "in-place update" (US2010031245, US2010031246, US2010030823, WO2008084488).

References relevant to classification in this group

This subgroup does not cover:

Update program code stored in non-alterable ROM	G06F 8/66
Low level details of writing to solid-state storage	G11C 16/10

Informative references

Attention is drawn to the following places, which may be of interest for search:

Changing the capability of a processor by loading new microcode, e.g. representing a different instruction set	G06F 9/24
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G06F 8/67

{while running}

Definition statement

This subgroup covers:

Updating software while it is executing/running.

Specific topics included:

Hot-plugging of new software into a running system;

Run-time adaptation of the functionality of executable code by relinking to new code modules.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Telecommunication systems,	H04Q 3/545
Power plants, Industrial process controllers	G05B 19/042

Special rules of classification within this group

Relevant documents can be in any group where some kind of real-time or high-availability system is involved.

G06F 8/68

{Incremental; Differential}

Definition statement

This subgroup covers:

Update methods explicitly demonstrating how a new version of software is created from an old version and update instructions and/or differential data.

The most simple way to update a piece of software from a first version to a second version is to remove the first version in its entirety and replace it by the entire second version. This method, although conceptually simple, is highly inefficient, especially in the case where the second version differs only slightly from the first version:

- It is always necessary to provide the target with the entire second version; if a network is involved, this puts a high burden on the network.
- It might take a long time to perform the update because the entire first version has to be deleted and the entire second version has to be written.

This class tackles this problem in that the update is performed by using the existing instance of the first version as a basis and to generate the instance of the second version therefrom. The scope of the class can thus be described as dealing with the details of how to modify an existing instance of the first version in order to arrive at the second version.

Typically, the second version is created by only changing those parts of the first version that actually change. This can be accomplished by creating a difference file (delta) that describes the differences of the second version with regards to the first version. The delta is provided to the target and applied to the first version thus yielding the second version. This delta can be passive - the delta is applied by an updater - or active -the delta contains instructions to actually perform the update.

Incremental update more generally refers to details of the steps involved to convert one piece of software into another. Differential update is more specific and explicitly uses differences between the two pieces of software.

References relevant to classification in this group

This subgroup does not cover:

Comparing a list of software actually installed on a device and a list of software that should be installed on a device; identify software not installed that should be installed on install this software on the device (EP1703382)	G06F 8/61
Delta in the context of version control	G06F 8/71
Delta in the context of file systems (e.g. US2003182325)	G06F 17/30067
Delta for version control systems	G06F 8/71
Delta for text documents	G06F 17/2211
Difference files for backup	G06F11/14A4B1M
Updating remote displays by only transmitting differences	G06F 3/1454
Differencing in data transmission	H03M 7/30

G06F 8/70

{Software maintenance or management}

Definition statement

This subgroup covers:

Adapting the source code of a software program in response to changing requirements, changing specifications, changes to the environment, detection of bugs, etc.

Starting from a specification of the new / modified functionalities the application should offer, analysing the existing source code in order to find the points to edit, generating the code from these specifications and incorporating it into the application.

References relevant to classification in this group

This subgroup does not cover:

Drafting of the specifications per-se	G06F 8/10
(Run-time) updating of already installed software	G06F 8/60

Special rules of classification within this group

Drafting of the specifications per-se; if the focus is on that, or it is a relevant aspect of the document, then the [G06F 8/10](#) should be (also) appropriate

Generation of code per-se; if the focus is on that, or it is a relevant aspect of the document, then one of the [G06F 8/30](#) should be (also) appropriate.

G06F 8/71

{Version control; Configuration management}

Definition statement

This subgroup covers:

Version control, administering version numbers and releases. Deals with the problem of managing a modular software system: keeping track of the changes and the different version of the modules, the interrelation between the modules, the effects of the changes of one module on the other modules, the problem of multiple users editing different modules.

Includes:

- Make, Build
- Analysing changes to/conflicts between sources
- SCCS-like tools
- dependency analysis
- Comparing/obtaining dates of last changes of sources/intermediates/targets;
- CVS - Concurrent Version Control, SVN, GIT, ...

References relevant to classification in this group

This subgroup does not cover:

Dealing with different versions of software in the context of software updating	G06F 8/65
Version control for text documents	G06F 17/2288
Configuration in the sense of changing parameters	G06F 9/44505
Configuration of peripheral devices	G06F 9/4411
Dependency analysis in compilers	G06F 8/433

G06F 8/72

{Code refactoring}

Definition statement

This subgroup covers:

Applying any change to a computer program's code which improves its readability or simplifies its structure without changing its results. In software engineering, "refactoring" a source code module often means modifying the module without changing its external behavior, and is sometimes informally referred to as "cleaning it up".

Code refactoring can be considered the design-time equivalent of code optimization ([G06F 8/443](#)). Code refactoring is concerned with improving the structure of the code in view of easier maintenance whereas code optimization is concerned to make the code better for a particular aspect (speed, size, energy).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Code Refactoring	the process of changing software such that the changes do not alter the external behavior of the code, yet improve the internal code structure
Re-engineering	In contrast to reverse engineering

G06F 8/73

{Program documentation}

Definition statement

This subgroup covers:

Augmenting program code with additional information in order to increase its understandability in view of easier maintenance.

Documenting program code, inserting comments in source code.

G06F 8/74

{Reverse engineering; Extracting design information from source code}

Definition statement

This subgroup covers:

Reverse engineering of HLL source code to its underlying design, model.

References relevant to classification in this group

This subgroup does not cover:

Decompilation and dissassembly	G06F 8/53
When the reverse engineering is performed in the context of binary to binary translation	G06F 8/52

Informative references

Attention is drawn to the following places, which may be of interest for search:

Protecting software against software analysis or reverse engineering, e.g. by code obfuscation	G06F 21/14
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G06F 8/75

{Structural analysis for program understanding}

Definition statement

This subgroup covers:

Static analysis of the structure of program code.

References relevant to classification in this group

This subgroup does not cover:

Monitoring program code execution	G06F 11/34
Analysing program code in order to identify reusable program parts	G06F 8/36

G06F 8/751

{Code clone detection}

Definition statement

This subgroup covers:

Detecting code clones, e.g. introduced as a result of copy & paste by the programmer.

References relevant to classification in this group

This subgroup does not cover:

Exlining, i.e. finding similar sequences of code to replace them with a procedure invocation	G06F 8/4436
Reuse, i.e. identifying recurring pieces of code for purposes of reuse	G06F 8/36

Informative references

Attention is drawn to the following places, which may be of interest for search:

Plagiarism detection for source code	G06F 21/10
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G06F 8/76

{Adapting program code to run in a different environment; Porting}

Definition statement

This subgroup covers:

Adapting program code to run in a different environment, i.e. a different architecture or operating system.

G06F 8/77

{Software metrics}

Definition statement

This subgroup covers:

Measurement of software metrics related to a software development project, such as product metrics and process metrics.

References relevant to classification in this group

This subgroup does not cover:

Measuring certain characteristics of a program in view of debugging	G06F 11/362
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Special rules of classification within this group

Not to be confused with [G06F 11/362](#), which deals with measuring certain characteristics of a program in view of debugging.

G06F 8/78

{Methods to solve the "Year 2000" [Y2K] problem}

Definition statement

This subgroup covers:

The Year 2000 problem, i.e. adapting software so as to comply with a not-foreseen date format.

Synonyms and Keywords

In patent documents the following abbreviations are often used:

Y2K	Year 2000
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G06F 9/00

Arrangements for programme control, e.g. control unit (programme control for peripheral devices [G06F 13/10](#); in regulating or control systems [G05B](#))

Definition statement

This group covers:

Program control for general purpose computers.

Runtime execution of programs.

References relevant to classification in this group

This group does not cover:

Arrangements for development of programs; Software engineering	G06F 8/00
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Program control for peripheral devices	G06F 13/10
Program control in regulating or control systems	G05B

Special rules of classification within this group

Note for use of these definitions:

In the sub-groups of [G06F 9/00](#) there are rules of classification which differ from the rules of the IPC, and are specified in this section.

The sub-groups mentioned under "Informative references"; "Limiting references" and "Relationship between large subject matter areas" are to be taken as indicators as to where the document to be classified may be forwarded or circulated for classifying.

Specific combinations or conventions of classification are mentioned under "Special rules of classification".

G06F 9/02

using wired connections, e.g. plugboard

Special rules of classification within this group

Not currently used, as old technology.

G06F 9/04

using record carriers containing only programme instructions
([G06F 9/06](#) takes precedence)

Special rules of classification within this group

Not currently used, as old technology.

G06F 9/06

using stored programme, i.e. using internal store of processing equipment to receive and retain programme

Definition statement

This subgroup covers:

Programming arrangements for computers having a stored program. Covers execution of stored programs, and arrangements therefor.

References relevant to classification in this group

This subgroup does not cover:

Arrangements for development of programs; Software engineering	G06F 8/00
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Program control for machine tools using a digital processor	G05B 19/042
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G06F 9/22

Micro-control or micro-programme arrangements

Definition statement

This subgroup covers:

Arrangements for executing microcode in general.

A next instruction of the program, when fetched from program store, is translated into lower level microinstructions, usually by using the instruction to index into a microprogram or control memory to fetch a series of microinstructions which are then decoded to obtain control signals to carry out the function of the machine instruction.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Execution of machine instructions	G06F 9/30
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Special rules of classification within this group

Precedence and classification rules:

The classification rules for sub-groups [G06F 9/22](#) - [G06F 9/28](#) is different from those used in **G06F/30** and sub-groups.

All aspects disclosed in a document which are deemed useful for search receive a class, not just the subject matter of the invention. Hence multiple sub-groups are to be used.

There is no distinction made between invention and additional subject matter, and the classes for additional subject matter are not used.

Within a sub-group of the hierarchy, lower level sub-groups have preference, unless otherwise specified. A single lower level class is given if appropriate. A higher level class is given for documents having features belonging to multiple sub-groups.

A higher level sub-group is used for an aspect not covered by its lower level sub-groups, and thus acts as a residual group for these sub-groups.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Microprogram	internal set of instructions used to translate a machine instruction of the stored program into a series of control signals. The microprogram is usually fixed at runtime, and defines the operations of the processor. Changing the microprogram changes the functionality of the processor, i.e. what type of operations it can carry out, and how these are carried out.
Nanoinstructions	instructions of a level lower than microinstructions i.e. multiple nanoinstructions are used to execute a microinstruction.

Synonyms and Keywords

In patent documents the following expressions "microprogram", "microcode", "firmware" and "microinstructions" are often used as synonyms.

G06F 9/223

{Execution means for micro-instructions irrespective of the micro-instruction function, e.g. decoding of micro-instructions and nano-instructions; timing of micro instructions; programmable logic arrays; delays and fan-out problems}

Definition statement

This subgroup covers:

Microinstruction execution aspects independent of the type of microinstruction, e.g. decoding of microinstructions; timing.

Includes PLAs used as sequencers for microcode.

Synonyms and Keywords

In patent documents the following expressions "PLA" and "Programmable Logic Array" are often used as synonyms.

G06F 9/226

{Micro instruction function e.g. input/output micro-instruction; diagnostic micro-instruction; micro-instruction format}

Definition statement

This subgroup covers:

Specific types of microinstruction operations.

Microinstruction set, microinstruction format.

G06F 9/24

Loading of the micro-programme

Definition statement

This subgroup covers:

- Loading of microcode implying altering the processor functionality;
- Changing the processor operations by loading or modifying microcode in the control store, thereby altering the way in which instructions are implemented in microcode;
- Fetching control microcode from ROM into RAM for execution;
- Patching by loading new microcode. Usually implemented by substituting the microcode at a particular instruction address in the microstore by a correct version during instruction fetching.

Relationship between large subject matter areas

Loading of operating system or application programs; loading of new versions of software [G06F 9/445](#).

G06F 9/26

Address formation of the next micro-instruction ([G06F 9/28](#) takes precedence){Microprogram storage or retrieval arrangements}

Definition statement

This subgroup covers:

- microinstruction addressing arrangements;
- sequencers for microcode;
- microinstruction storage, and microinstruction retrieval or fetching.

Special rules of classification within this group

[G06F 9/28](#) takes preference.

Synonyms and Keywords

In patent documents the following expressions "micro-instruction" and "microinstruction" or "micro-program" and "microprogram" are used as synonyms.

G06F 9/261

{Micro-instruction address formation}

Definition statement

This subgroup covers:

Formation of the microinstruction address e.g. using lookup table.

G06F 9/262

{Arrangements for next micro-instruction selection}

Definition statement

This subgroup covers:

Retrieval of the next microinstruction

G06F 9/264

{Micro-instruction selection based on results of processing}

Definition statement

This subgroup covers:

Address formation of the next microinstruction by selection according to the results of processing.

Next microaddress or microinstruction derived directly from the program flow, e.g. program counter, branch.

G06F 9/265

{by address selection on input of storage}

Definition statement

This subgroup covers:

Address formation of the next microinstruction by selection of address on input of storage.

Selecting at the input to the control store, which address to use, and therefore which microinstruction is retrieved.

G06F 9/267

{by instruction selection on output of storage}

Definition statement

This subgroup covers:

Address formation of the next microinstruction by selection of microinstruction on output of storage.

Inputting several addresses into the control store, and selecting at the output of the control store which microinstruction to execute.

G06F 9/268

{Micro-instruction selection not based on processing results, e.g. interrupt, patch, first cycle store, diagnostic programs}

Definition statement

This subgroup covers:

Address formation of the next microinstruction by selection not based on the results of processing.

Selecting next microaddress or microinstruction not derived directly from the program flow, e.g. interrupt, patching.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Address formation of the next machine instruction for runtime patching	G06F 9/328
Patching by microcode loading	G06F 9/24

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Patching	repairing errors of microcode in read-only storage. Usually implemented by substituting the microcode at a particular address in the microstore by a correct version during fetching.
Interrupt	changing execution flow in response to an (external) event which must be handled with a higher priority.

G06F 9/28

Enhancement of operational speed, e.g. by using several micro-control devices operating in parallel

Definition statement

This subgroup covers:

Means to improve speed of microcode execution e.g. dual control stores.

Parallel or concurrent execution of microinstructions.

Special rules of classification within this group

Takes precedence over other sub-groups of [G06F 9/22](#).

G06F 9/30

Arrangements for executing machine-instructions, e.g. instruction decode (for executing micro-instructions [G06F 9/22](#); for executing subprogrammes [G06F 9/4425](#))

Relationship between large subject matter areas

- Arrangements for executing microinstructions [G06F 9/22](#);
- arrangements for executing subprograms **G06F9/40**;
- arrangements for executing specific programs [G06F 9/44](#);
- arrangements for executing multiple programs [G06F 9/46](#);
- arrangements for development of stored programs; Software engineering; CASE tools [G06F 8/00](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Arrangements for executing microinstructions	G06F 9/22
Arrangements for executing subprograms	G06F9/40

Special rules of classification within this group

These rules of classification apply to the subclass [G06F 9/30](#) and all lower level subclasses:

Sub-groups mentioned under the heading of "Relationship..." and limiting references are to be used for circulation of documents during classification.

All aspects disclosed in a document which are deemed useful for search receive a subclass, not just the subject matter of the invention. Hence multiple subclasses are to be used.

There is no distinction made between invention and additional subject matter, and the subgroups for additional subject matter are not used.

Note that combinations of subclasses are possible from different levels, or from the same level within the hierarchy.

Within a subclass of the hierarchy, lower level subclasses have preference, unless otherwise specified. Documents may be classified in multiple lower level subclasses. A higher level subclass is used for an aspect not covered by its lower level subclasses, and thus acts as a residual group for these subclasses.

The following IPC subclasses are not used in this classification scheme, but are covered by the subgroups listed here:

G06F9/302 covered by [G06F 9/3001](#);

G06F9/305 covered by [G06F 9/30029](#);

G06F9/308 covered by [G06F 9/30018](#);

G06F9/312 covered by [G06F 9/30043](#);

G06F9/315 covered by [G06F 9/30032](#);

G06F9/318 covered by [G06F 9/30181](#).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Machine instructions	Executable instructions of the processor, which can be decoded to obtain control signals
----------------------	--

G06F 9/30003

{Arrangements for executing specific machine instructions}

Definition statement

This subgroup covers:

Execution of specific individual machine instructions.

Adaptation of hardware, and hardware control, to carry out the execution of a specific machine instruction.

Special purpose instructions, being instructions not classifiable under subclasses.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Multiple parallel functional units executing instructions	G06F 9/3885
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Special rules of classification within this group

In the subclasses of [G06F 9/30003](#), if the execution of the machine instruction includes special arrangements for the setting of a condition code or flag, then also use [G06F 9/30094](#).

In the case of a single machine instruction which carries out a combination of operations, use a subclass for each operation.

In the subclasses hereof, the terms in capitals which are used as examples, refer to well-known types of instructions characteristic to that subclass.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Machine instructions	instructions executable by the processor, which can be decoded to obtain control signals
----------------------	--

G06F 9/30007

{to perform operations on data operands}

Definition statement

This subgroup covers:

Specific instruction to perform operation between input data operands, usually returning an output data operand as the result.

Relationship between large subject matter areas

Adders [G06F 7/50](#)

Multipliers [G06F 7/52](#)

Arithmetic Logic Units [G06F 7/57](#)

Informative references

Attention is drawn to the following places, which may be of interest for search:

Specific instruction for operation on memory operands	G06F 9/3004
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G06F 9/3001

{Arithmetic instructions}

Definition statement

This subgroup covers:

Specific arithmetic instruction for example adding, multiplying, multiply accumulate.

Includes how to select the specific operation to execute in an ALU.

Relationship between large subject matter areas

Adders [G06F 7/50](#).

Multipliers [G06F 7/52](#).

Arithmetic Logic Units [G06F 7/57](#).

Synonyms and Keywords

In patent documents the following abbreviations are often used:

ALU	Arithmetic Logic Unit
MAC	Multiply-Accumulate operation
MACU	Multiply-Accumulate Unit

G06F 9/30014

{with variable precision}

Definition statement

This subgroup covers:

Arithmetic operation where the bit width operated on may be variable.

Bit-sliced arithmetic operation.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Multiple arithmetic units executing an instruction in tandem or cascaded	G06F 9/3893
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G06F 9/30018

{Bit or string instructions; instructions using a mask}

Definition statement

This subgroup covers:

Specific instruction for operation on a series of connected bits, bytes or characters, for example using a mask to select certain portions of a data string.

Examples include the EDIT instruction which alters a portion of a character string, or a Find-First-One instruction which detects the position of the first '1' in a string of bits.

Includes cyclic redundancy check instructions.

G06F 9/30021

{Compare instructions, e.g. Greater-Than, Equal-To, MINMAX}

Definition statement

This subgroup covers:

Specific instruction for comparison between two operands.

Includes matching, greater/less than, minmax instruction.

Synonyms and Keywords

In patent documents the following abbreviations are often used:

MINMAX	instruction to find the minimum of a series of input operands, alternatively to find the maximum of the same.
--------	---

G06F 9/30025

{Format conversion instructions, e.g. Floating-Point to Integer, decimal conversion}

Definition statement

This subgroup covers:

Specific instruction for conversion from one data format to another.

Includes Endian conversion; Conversion between integer and floating-point; Decimal conversion instructions.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Data re-arranging instruction, e.g. Shuffle, Permute	G06F 9/30032
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G06F 9/30029

{Logical and Boolean instructions, e.g. XOR, NOT}

Definition statement

This subgroup covers:

Specific instruction for logical operation or combination.

G06F 9/30032

{Movement instructions, e.g. MOVE, SHIFT, ROTATE, SHUFFLE}

Definition statement

This subgroup covers:

Specific instruction for moving, rearranging, or operating on data within a register.

Examples include : Move instruction which transfers data between registers; Permute instruction which changes the order of data in a register; Rotate or Shift instruction which moves bits or bytes within a register.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Instruction for operation on memory operands	G06F 9/3004
Instruction for operation on string operands	G06F 9/30018
Instructions for format conversion operations	G06F 9/30025

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Move	instructions to pass data between memory locations, or between registers, without operating on the data.
Shift	instructions to move data in a serial fashion from one location to another, where the distance moved is usually less than a word, e.g. shifting data within a register by a few bits.
Rotate	instructions which are shift instructions where the bits shifted serially out are inserted into the location at the opposite end.
Permute or Shuffle	instruction which intermingles parts of a datum to produce a new datum.

G06F 9/30036

{Instructions to perform operations on packed data, e.g. vector operations}

Definition statement

This subgroup covers:

Specific instruction operating on multiple data stored in a single register, thereby effecting a SIMD operation.

Includes instructions operating on vector data.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Multiple functional units executing an instruction in parallel	G06F 9/3885
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Special rules of classification within this group

This subclass may be used in combination with other subclasses of [G06F 9/30007](#), according to the operation performed.

G06F 9/3004

{to perform operations on memory}

Definition statement

This subgroup covers:

Specific instruction for operation on memory operands in general.

Specific instruction for control operation on memory.

Memory to memory Move instruction.

Stack instructions POP, PUSH

Table lookup instructions.

A combination of a memory operation and further operation e.g. atomic memory operations such as read-modify-write, test-and-set.

Register allocation instructions.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Specific instruction for data operation	G06F 9/30007
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Special rules of classification within this group

For atomic memory operations use in combination with serialisation control instructions [G06F 9/30087](#), and possibly [G06F 9/3834](#) for memory consistency.

G06F 9/30043

{LOAD or STORE instructions; Clear instruction}

Definition statement

This subgroup covers:

Specific instruction to read or write data from a memory location, e.g. LOAD, STORE, Load Multiple.

Specific instruction to clear or reset a memory location, e.g. CLEAR.

Register reset or clear instructions are also found here.

Table look-up instructions.

Context saving or restoring instructions.

Special rules of classification within this group

Register reset or clear instructions are also found here.

For atomic memory operation use also serialisation control operation [G06F 9/30087](#).

For Load Multiple when executed as an iterative instruction use also [G06F 9/30065](#).

G06F 9/30047

{Prefetch instructions; cache control instructions}

Definition statement

This subgroup covers:

Specific instruction for control data or instruction prefetching from memory, e.g. Hint instruction.

Specific instruction to control cache operation, e.g. Cache Flush.

G06F 9/3005

{to perform operations for flow control}

Definition statement

This subgroup covers:

- Specific instruction to control program flow in general.
- Execution of an instruction to select a next instruction other than the next sequential instruction, e.g. for branching.
- Execution of an instruction for facilitating branching, e.g. Prepare-To-Branch instruction.

Includes specific instruction for monitoring or tracing program flow e.g. breakpoint instruction; flow signature instruction.

G06F 9/30054

{Unconditional branch instructions}

Definition statement

This subgroup covers:

Special adaptations to execute a specific instruction which branches to a target address independent of any condition.

Examples of unconditional branch instructions are CALL, GOTO insofar as these are unconditional.

Special rules of classification within this group

Only to be used when there is subject matter relating to special adaptations or details of handling of a branch instruction.

G06F 9/30058

{Conditional branch instructions}

Definition statement

This subgroup covers:

Specific instruction which causes branching to a target address dependent on a runtime condition, else continues execution with the next sequential instruction.

Includes IF-THEN-ELSE constructions.

Special rules of classification within this group

Only to be used when there is subject matter relating to special adaptations or details of handling of a branch instruction.

G06F 9/30061

{Multi-way branch instructions, e.g. CASE}

Definition statement

This subgroup covers:

Specific instruction which causes a branching to one of several alternative target addresses depending on a runtime condition.

Instruction which branches to a variable target address, e.g. indirect (register specified) branch target address,

G06F 9/30065

{Loop control instructions; iterative instructions, e.g. LOOP, REPEAT}

Definition statement

This subgroup covers:

Specific instruction used for loop control, e.g. specific loop start or end instructions.

Specific instruction which is repeatedly executed, thereby forming a (short) loop.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Address formation for loops, loop detection	G06F 9/325
Loop buffering	G06F 9/381

G06F 9/30069

{Instruction skipping instructions, e.g. SKIP}

Definition statement

This subgroup covers:

Specific instruction which causes a number of instructions to be skipped i.e. not executed, thus effecting a (short) forward branch, e.g. SKIP.

A skip of a single instruction is regarded as conditional instruction execution, not skipping.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Conditional branch instruction	G06F 9/30058
Single instruction skip as conditional execution.	G06F 9/30072

G06F 9/30072

{to perform conditional operations, e.g. using guard}

Definition statement

This subgroup covers:

Specific instruction for conditional operation depending on a runtime condition, which are not for control of program flow.

The operation carried out depends on a runtime condition, for example ADD or SUBTRACT depending on the value of the sign bit. Another example is a MOVE which is executed or not depending on a runtime condition.

Includes instructions which are executed conditional on a predicate or guard.

Includes conditional instructions in a branch shadow.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Conditional branch instruction	G06F 9/30058
Instruction which executes differently according to a mode	G06F 9/30189
Multiple instruction skipping for forward branch.	G06F 9/30069

Special rules of classification within this group

[G06F 9/30058](#) has precedence.

May be used in combination with other sub-groups of the [G06F 9/30003](#) according to the operation performed by the conditional instruction, e.g. conditional MOVE in combination with [G06F 9/30032](#).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Conditional	dependent on a runtime condition or operational status.
Guard	a tag indicating a condition which is assigned to an instruction. According to the outcome of the condition evaluation, the instruction is executed or skipped. Often assigned by the compiler to avoid branches
Predicate	same meaning as 'guard'

G06F 9/30076

{to perform miscellaneous control operations, e.g. NOP}

Definition statement

This subgroup covers:

Specific instruction for operation control in general.

Includes mode switching instruction.

Specific instruction for instruction execution control in general.

Includes mode switching instruction.

NOP instructions are here, but multicycle NOPs are considered pipeline delay control instructions, and are in **30A8H**.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Specific instruction for program flow control NOP used as a pipeline delay instruction	G06F 9/3005 G06F 9/30079
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G06F 9/30079

{Pipeline control instructions}

Definition statement

This subgroup covers:

Specific instruction to control an instruction pipeline, e.g. HALT, FLUSH

Instructions for variable delay of pipeline or execution, e.g. multicycle NOP.

G06F 9/30083

{Power or thermal control instructions}

Definition statement

This subgroup covers:

Specific instruction to control power consumption or thermal aspects of the processor, e.g. SLEEP.

G06F 9/30087

{Synchronisation or serialisation instructions}

Definition statement

This subgroup covers:

Specific instruction to control serialisation of instruction execution; to control synchronisation of instruction execution.

Includes specific instructions used to implement memory locks; barriers.

Includes instructions to facilitate atomic execution.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Program synchronisation ; Mutual exclusion	G06F 9/52
--	---------------------------

Special rules of classification within this group

For atomic memory operations use also [G06F 9/3004](#).

For barrier or fence instructions use also [G06F 9/3834](#).

For synchronisation instruction which affects the execution of a thread use also [G06F 9/3009](#).

G06F 9/3009

{Thread control instructions}

Definition statement

This subgroup covers:

Specific instruction to control multi-threading; starting and stopping threads, e.g. FORK; JOIN.

G06F 9/30094

{Condition code generation, e.g. Carry, Zero flag}

Definition statement

This subgroup covers:

Special arrangements for the generation or storage of runtime conditions, e.g. flags; status register.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Execution mode flags	G06F 9/30189
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G06F 9/30098

{Register arrangements}

Definition statement

This subgroup covers:

Groups of registers; register files.

Register file addressing; addressing partial registers.

Accessing register file e.g. contention.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Register renaming	G06F 9/384
Register address space extension	G06F 9/30138

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Register	set of one-bit storages, e.g. latches, accessed in parallel
Register file	set of registers. May be implemented in a single or in multiple memories

Synonyms and Keywords

In patent documents the following abbreviation are often used

GPR	general purpose register
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G06F 9/30101

{Special purpose registers}

Definition statement

This subgroup covers:

Special adaptation of the use of single or multiple registers for a dedicated purpose, not being general purpose registers. May not be part of the register file.

Examples include particular use of dedicated address register, control register, status register, condition code register, Top Of Stack register.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Program counter registers	G06F 9/321
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Special rules of classification within this group

Only to be used when there is subject matter relating to special adaptations or details of use of a special purpose register.

G06F 9/30105

{Register structure}

Definition statement

This subgroup covers:

Details of the structure of an individual register.

Registers having associated bits e.g. valid bits, tags, flags.

G06F 9/30109

{having multiple operands in a single register}

Definition statement

This subgroup covers:

Registers which are logically partitioned into multiple operands, e.g. for packed data.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Multiple registers used for variable length operands	G06F 9/30112
--	------------------------------

G06F 9/30112

{for variable length data, e.g. single or double registers}

Definition statement

This subgroup covers:

Register structure for variable length operands i.e. variable length data can be stored.

Use of partial registers for short data.

Combinations of registers for longer or higher precision data, e.g. by concatenation.

Accessing of variable length registers.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Partitioned registers for multiple operands, e.g. packed data	G06F 9/30109
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G06F 9/30116

{Shadow registers, e.g. coupled registers, not forming part of the register space}

Definition statement

This subgroup covers:

Registers which cannot be addressed by an instruction, and hence are invisible to the architecture.

Register with an associated copy, e.g. for saving of architectural state.

Special rules of classification within this group

Use in combination with [G06F 9/30123](#) for shadow register set used for another context.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Register space	the address space used by registers i.e. the range of program addressable register locations.
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G06F 9/3012

{Organisation of register space, e.g. banked or distributed register file}

Definition statement

This subgroup covers:

The physical or logical organisation of the register space in general.

Includes partitioned, distributed or banked register files, e.g. per execution unit.

Local and global register files.

Special rules of classification within this group

Register banks for register space extension use [G06F 9/30138](#).

Register banks for context data use [G06F 9/30123](#).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Register space	logical address space for registers, i.e. the range of addresses defined by a register specifier
----------------	--

G06F 9/30123

{according to context, e.g. thread buffers}

Definition statement

This subgroup covers:

Organisation of sets of registers used for storing the data of a particular context, e.g. local variables.

Includes thread buffers used to hold the context of a thread, and forming part of an instruction stream.

Special rules of classification within this group

Use in combination with [G06F 9/30116](#) for shadow register set used for another context.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Context data	operands and data representing the architectural state of a context, and which needs to be saved on a context switch
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G06F 9/30127

{Register windows}

Definition statement

This subgroup covers:

Organisation of sets of registers used to implement register windows.

May have a pointer to the first window location, which may be used as a base address. Used for example for fast context switching, by moving from a current window to a next window.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Register window	set of contiguous registers used to implement a window to hold context data
-----------------	---

G06F 9/3013

{according to data content, e.g. floating-point registers, address registers}

Definition statement

This subgroup covers:

Organisation of sets of registers used to store different types of data.

Includes address registers, Boolean registers, floating point registers, parameter registers.

G06F 9/30134

{Register stacks; shift registers}

Definition statement

This subgroup covers:

Register stacks are a series of register locations implementing a stack. The register stack is addressable generally using a register containing the Top-of Stack pointer. Writing to the TOS location implies adding an entry to the top of the stack, reading implies removing an entry from the top of the stack.

The implementation of stack read/write operation in a register stack may involve physically shifting the entries in the queue up or down using shift registers; or alternatively may involve incrementing or decrementing the TOS pointer to access the next or previous register.

Details of shift registers implementing a FIFO buffer are also found here.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Special purpose register for TOS pointer	G06F 9/30101
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Register stack	contiguous set of register locations used to implement a stack. May be implemented as a shift register
Shift register	register which shifts its contents in a bit-parallel fashion into an adjacent register.

Synonyms and Keywords

In patent documents the following abbreviations are often used

TOS	Top of Stack
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G06F 9/30138

{Extension of register space, e.g. register cache}

Definition statement

This subgroup covers:

Increasing or decreasing the number of available addressable locations in register address space, e.g. more or less physical registers than logical registers, register cache.

Extension of register address length e.g. using indexing.

G06F 9/30141

{Implementation provisions of register files, e.g. ports}

Definition statement

This subgroup covers:

- Hardware implementation of register files.
- Register file port architecture; address or data ports.
- Internal bypass path of register files.
- Adaptations of register file hardware for particular problems, e.g. for power saving; for fault tolerance.

Includes transposing register file being accessible vertically or horizontally.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Bypass path	direct connection between a register file input and output.
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G06F 9/30145

{Instruction analysis, e.g. decoding, instruction word fields}

Definition statement

This subgroup covers:

Decoding of instructions in general, of opcode in particular.

Instruction format, instruction encoding.

Instruction set as a whole.

Relationship between large subject matter areas

Decoding of micro-instructions [G06F 9/223](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Runtime instruction translation	G06F 9/3017
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Special rules of classification within this group

Runtime instruction translation using a decoder is classified under [G06F 9/3017](#) and sub-groups, even if this involves decoding, since the purpose is translation.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

RISC	Reduced Instruction Set Computer. Architecture having set of simple instructions which are decoded into direct control signals, and which take a single cycle to execute.
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CISC	Complex Instruction Set Computer. Architecture having set of complex instructions which are decoded into internal (native; microcode) instructions, and which may take multiple cycles to execute.
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G06F 9/30149

{of variable length instructions}

Definition statement

This subgroup covers:

Decoding of variable length instructions.

Includes instruction where the relative length of operation and operand part is variable.

Ensuring a whole instruction is decoded. Parsing VLI instructions.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Instruction pre-fetching when instruction length is variable, e.g. line-crossing fetch; alignment in instruction buffer	G06F 9/3816
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

VLI	instructions of varying lengths
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Synonyms and Keywords

In patent documents the following abbreviations are often used:

VLI	Variable Length Instruction
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G06F 9/30152

{Determining start or end of instruction; determining instruction length}

Definition statement

This subgroup covers:

Arrangements for determining and/or marking the boundaries of a variable length instruction; Special arrangements for determining the length of a variable length instruction other than by decoding the length.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Pre-decoding of instructions	G06F 9/382
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

VLI	instructions of varying lengths
-----	---------------------------------

Synonyms and Keywords

In patent documents the following abbreviations are often used:

VLI	Variable Length Instruction
-----	-----------------------------

G06F 9/30156

{Special purpose encoding of instructions, e.g. Gray coding}

Definition statement

This subgroup covers:

Instruction encodings to achieve a secondary effect, e.g. power saving, saving memory space, security, fault tolerance.

Relationship between large subject matter areas

Computer-aided instruction set design [G06F 17/50](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Runtime instruction translation for compressed or encrypted instructions	G06F 9/30178
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Special rules of classification within this group

Use in combination with [G06F 9/30178](#) for decompression by translation, or with [G06F 9/3822](#) for format field decoding for VLIW.

G06F 9/3016

{Decoding the operand specifier, e.g. specifier format}

Definition statement

This subgroup covers:

Decoding operand fields of instructions; Format of operand fields of instructions.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Decoding the opcode of instructions	G06F 9/30145
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G06F 9/30163

{with implied specifier, e.g. top of stack}

Definition statement

This subgroup covers:

Instruction format which is shorter by having operand specifier field(s) missing but implied, e.g. Top of Stack, accumulator, dedicated register.

G06F 9/30167

{of immediate specifier, e.g. constants}

Definition statement

This subgroup covers:

Decoding of immediate operand specifiers or constants; Concatenation of immediates; Buffering of immediates.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Immediate	data in an instruction to be used directly as an operand, e.g. without storing in a register
Constant	same meaning as 'immediate'

G06F 9/3017

{Runtime instruction translation, e.g. macros}

Definition statement

This subgroup covers:

Runtime translation of an instruction by decoding an instruction which is non-native, to produce an executable instruction or set of instructions. The decoding of instructions into microinstructions, being of a lower level, is not meant.

Includes altering the format or encoding of the input instruction, e.g. length of fields.

Includes translating a single instruction into multiple executable instructions, or the reverse (macro formation).

Relationship between large subject matter areas

- Decoding of micro-instructions [G06F 9/223](#);
- instruction emulation or interpretation [G06F 9/455](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Decoding of instructions	G06F 9/30145
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Macro	An opcode which is an alias for a series of instructions, i.e. a function; Non-native instruction; An instruction which is not executable in the architecture of the processor.
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G06F 9/30174

{for non-native instruction set, e.g. Javabyte, legacy code}

Definition statement

This subgroup covers:

Runtime translation of a non-native instruction into an executable instruction using hardware means, e.g. decoder, look-up table.

Relationship between large subject matter areas

Instruction emulation or interpretation [G06F 9/455](#).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Non-native instruction set	set of instructions intended to execute on a different architecture, which cannot run without translation or reformatting. Legacy code may be considered non-native.
Non-native instruction	an instruction which is not executable in the architecture of the processor.

G06F 9/30178

{of compressed or encrypted instructions}

Definition statement

This subgroup covers:

Runtime translation of an encrypted or compressed instruction into an instruction which can be executed.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Special encoding of instructions for saving memory or power.	G06F 9/30156
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G06F 9/30181

{Instruction operation extension or modification}

Definition statement

This subgroup covers:

Modification or extension of the execution of an instruction in general.

Modifications to the instruction itself, or to the architecture, which increase the number of operations available to the architecture.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Execution unit with adaptable datapath for complex operation	G06F 9/3897
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G06F 9/30185

{according to one or more bits in the instruction, e.g. prefix, sub-opcode}

Definition statement

This subgroup covers:

Modification of the operation of an instruction according to one or more bits comprised in the instruction.

G06F 9/30189

{according to execution mode, e.g. mode flag}

Definition statement

This subgroup covers:

Modification of the operation of an instruction according to a mode of operation, e.g. mode flag.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Mode switching instruction	G06F 9/30076
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G06F 9/30192

{according to data descriptor, e.g. dynamic data typing}

Definition statement

This subgroup covers:

Modification of the operation of an instruction according to a data type descriptor, e.g. dynamic data typing.

G06F 9/30196

{using decoder, e.g. decoder per instruction set, adaptable or programmable decoders}

Definition statement

This subgroup covers:

Modification of the operation of an instruction using more than one decoder, or a decoder which is adaptable.

Extension of the instruction set using multiple decoders for multiple instruction sets.

G06F 9/32

Address formation of the next instruction, e.g. incrementing the instruction counter, jump ([G06F 9/38](#) takes precedence; sub-programme jump [G06F 9/4426](#))

Definition statement

This subgroup covers:

Selecting or calculating the next instruction address.

Sequencers for machine instructions.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Concurrent instruction execution, e.g. pipeline, look ahead	G06F 9/38
Dynamic branch address prediction	G06F 9/3844
Static branch address prediction	G06F 9/3846
Instruction prefetching	G06F 9/3802
Subprogram jump	G06F9/42

G06F 9/321

{Programme or instruction counter, e.g. incrementing}

Definition statement

This subgroup covers:

Incrementing/decrementing means for the program counter.

Selection of next PC from pre-calculated constant values, e.g. +1, +2, 0, -1.

PC arrangements, e.g. multiple PCs.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Program counter	a dedicated register which holds the address of the current instruction in the program sequence
-----------------	---

Synonyms and Keywords

In patent documents the following abbreviations are often used:

PC	Program counter
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G06F 9/322

{for non-sequential address}

Definition statement

This subgroup covers:

Address formation, or selection, for the next instruction, being a non-sequential address.

Address calculation or selection, for the execution of branch instructions in general, e.g. for multiple types of branch.

Selection of next instruction address from various alternatives, e.g. PC, a constant, branch target, branch fall-through.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

PC address formation	address calculation, i.e. address selection
----------------------	---

G06F 9/324

{using program counter relative addressing}

Definition statement

This subgroup covers:

Formation of the next instruction address using an offset from the program counter.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Address formation of the instruction operand or result using PC-relative addressing	G06F 9/3557
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G06F 9/325

{for loops, e.g. loop detection, loop counter}

Definition statement

This subgroup covers:

Formation of the next instruction address for a loop.

Loop formation; loop detection.

Loop counters.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Buffering of loop instructions	G06F 9/381
Specific loop control instructions or iterative instructions	G06F 9/30065

G06F 9/327

{for interrupts}

Definition statement

This subgroup covers:

Formation of the next instruction address for an interrupt, using hardware means e.g. look-up table.

G06F 9/328

{for runtime instruction patching}

Definition statement

This subgroup covers:

Formation of the address of a next instruction for the purpose of patching an instruction.

Includes detection of program addresses or instructions to be patched.

Relationship between large subject matter areas

Patching of software or loading of new version of software [G06F 9/445](#).

Instruction emulation [G06F 9/455](#).

Runtime patching of microcode in ROM [G06F 9/268](#).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Patching	repairing errors in machine instructions in read-only storage at runtime. Usually implemented by substituting the instruction at a particular address in the memory by a correct version.
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G06F 9/34

**Addressing or accessing the instruction operand or the result;
{Formation of operand address; Addressing modes (address translation
[G06F 12/00](#))}**

Definition statement

This subgroup covers:

- Addressing the instruction operand or the result.
- Operand addressing modes in general.
- Endian conversion.

Relationship between large subject matter areas

Addressing of memories in general, address translation [G06F 12/00](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Accessing an operand in a pipeline	G06F 9/3824
Address translation	G06F 12/00

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Addressing mode	type of operand addressing e.g. indirect, indexed
-----------------	---

G06F 9/342

{Extension of operand address space}

Definition statement

This subgroup covers:

Increasing the size of the addressable operand memory space i.e. increasing the number of available addressable locations.

Extending the operand address space by increasing the bit length of addresses.

Extending the operand address space by use of multiple address spaces; bank pointer.

Relationship between large subject matter areas

Address space extension in memory systems [G06F 12/0615](#)

Informative references

Attention is drawn to the following places, which may be of interest for search:

Organisation of register space	G06F 9/3012
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G06F 9/345

of multiple operands or results {(addressing multiple banks [G06F 12/06](#))}

Definition statement

This subgroup covers:

Address formation for a series or group of operands, e.g. for an array.

Address formation for pairs of operands at adjacent addresses i.e. addr;addr+1.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Prediction of operand addresses for operand prefetching	G06F 9/3832
Addressing multiple banks	G06F 12/06

Special rules of classification within this group

May also be classified according to the addressing mode.

G06F 9/3455

{using stride}

Definition statement

This subgroup covers:

Address formation for a series of operands by adding a stride value to the previous address to form the next address.

May be used to predict the next operand address.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Stride	offset or displacement which may be a constant.
--------	---

G06F 9/35

Indirect addressing, {i.e. using single address operand, e.g. address register}

Definition statement

This subgroup covers:

Address formation using a single address operand, e.g. using the contents of an address register or GPR.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Indirect addressing	the address is the value contained in the register specified in the instruction.
Direct addressing	the address is the value specified in the instruction.
GPR	general purpose register

G06F 9/355

Indexed addressing {i.e. using more than one address operand}

Definition statement

This subgroup covers:

Operand address formation using more than one address operand, e.g. using base + index/offset registers.

Indexed address formation or calculation details.

Uses at least two address operands which are added or concatenated. The resulting address may be longer than the base address, hence indexed addressing may be also used for address space extension.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Address space extension	G06F 9/342
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Indexed addressing	the address is the value contained in the base register specified in the instruction summed with the value contained in the index register specified in the instruction. The index part of the address usually consists of less bits than the base part of the address, and is therefore an offset from the base address
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Synonyms and Keywords

In patent documents the following expressions/ words "index", "offset", "displacement" and "delta" are often used as synonyms.

G06F 9/3552

{using wraparound, e.g. modulo or circular addressing}

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Wraparound	incrementing the maximum address value, e.g. 11111111 leads to wraparound to the lowest address value, e.g. 00000000, so that addressing is continuous, avoiding an overflow error
Modulo or circular addressing	same meaning than Wraparound

G06F 9/3555

{using scaling, e.g. multiplication of index}

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Scaling	indexed addressing where the index address is multiplied by a factor before adding to the base address
---------	--

G06F 9/3557

{using program counter as base address}

Definition statement

This subgroup covers:

- Address formation using the program counter as a base for indexed addressing;
- PC-relative addressing.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Next instruction addressing using an offset from the program counter.	G06F 9/324
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G06F 9/38

Concurrent instruction execution, e.g. pipeline, look ahead

Definition statement

This subgroup covers:

Simultaneous execution of instructions in general, in parallel or pipelined.

Special architectures where instruction execution is concurrent.

Includes stack machines.

Relationship between large subject matter areas

Concurrent program execution: [G06F 9/46](#).

G06F 9/3802

{Instruction prefetching}

Definition statement

This subgroup covers:

Prefetching and fetching of instructions for execution, in general.

Instruction buffering; instruction caches

G06F 9/3804

{for branches, e.g. hedging, branch folding}

Definition statement

This subgroup covers:

Prefetching of instructions for branch paths.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Hedging	Fetching both paths of an unresolved conditional branch
Branch folding	Removal of a branch instruction from the instruction stream, e.g. by including the branch condition in an instruction as a predicate

G06F 9/3806

{using address prediction, e.g. return stack, branch history buffer}

Definition statement

This subgroup covers:

Using a history of previous branch target addresses to predict the address to fetch from, e.g. branch target buffer;

Address buffers for predicting next fetch address for a branch, e.g. return address stack.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Dynamic prediction of branch direction	G06F 9/3844
Static prediction of branch direction	G06F 9/3846
Hybrid prediction of branch direction	G06F 9/3848

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

BTB	buffer indexed by an instruction fetch address or PC, which returns the predicted target address if the instruction is a taken branch.
BHT	buffer indexed by a branch instruction address, which returns a prediction of whether the branch is taken or not.
BDT	buffer indexed by a branch type at decode time, which returns a prediction of whether the branch is taken or not.

Return address stack	Stack to hold the program address to return to after a Call-type branch. The stack structure allows nesting of Calls.
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Synonyms and Keywords

In patent documents the following abbreviations are often used:

BTB	Branch Target Buffer
BHT	Branch History Table
BTAC	Branch Target Address Cache
BDT	Branch Decode Table

G06F 9/3808

{for instruction reuse, e.g. trace cache, branch target cache}

Definition statement

This subgroup covers:

- Prefetching of instructions intended to be used more than once, thereby saving fetch time;
- Buffering of instructions for reuse, e.g. trace cache;
- Branch target caches.

Relationship between large subject matter areas

Program tracing for monitoring [G06F 11/3466](#).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Branch target cache	History buffer of first instruction at a branch target, which returns an instruction rather than an address, thus saving fetch time.
Trace cache	Cache storing a history of previously executed paths through the program, as sequences of instructions. Accessing the trace cache returns the next predicted instructions in the sequence.

G06F 9/381

{Loop buffering}

Definition statement

This subgroup covers:

- Prefetching of instructions intended to be used in a loop, thereby saving fetch time;
- Buffering of instructions for loops.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Specific loop control instructions	G06F 9/30065
Formation of the next instruction address for a loop; detection of loops	G06F 9/325

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Loopshort backward branch	Sequence of instructions executing repetitively
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G06F 9/3812

{with instruction modification, e.g. store into instruction stream}

Definition statement

This subgroup covers:

Instruction prefetching in an architecture allowing instruction modification.

How to handle store-into-instruction-stream, wherein an instruction in memory is modified, e.g. by writing back a new operand value, hence the prefetched copy of the instruction is stale.

G06F 9/3814

{Implementation provisions of instruction buffers, e.g. prefetch buffer; banks}

Definition statement

This subgroup covers:

- Special arrangements for buffering of prefetched instructions;
- Prefetch buffers;
- Banked or partitioned instruction buffers.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Prefetch buffer	in this subclass, a buffer to hold a recently fetched set of instructions, usually between the instruction memory and the instruction decoder, e.g. cache line buffer.
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Synonyms and Keywords

In patent documents the expression/word "cross-modifying code" is often used with the meaning "instructions which can modify other instructions".

In patent documents the expression/word "self-modifying code" is often used with the meaning "instructions which can modify themselves".

G06F 9/3816

{Instruction alignment, e.g. cache line crossing}

Definition statement

This subgroup covers:

Arrangements for (correct) alignment of instructions in prefetch buffers.

Instruction prefetching which crosses a line in memory or cache, for example for variable length instructions.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Variable length instructions	G06F 9/30149
Predecoding instructions for alignment information	G06F 9/382

G06F 9/3818

{Decoding for concurrent execution}

Definition statement

This subgroup covers:

Decoding for enabling the concurrent execution of instructions.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Decoding of a single instruction	G06F 9/30145
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G06F 9/382

{Pipelined decoding, e.g. using predecoding}

Definition statement

This subgroup covers:

Decoding for enabling the pipelined execution of instructions.

Predecoding stage in a pipeline.

Partitioned decoding stage.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Instruction alignment using predecode information	G06F 9/3816
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G06F 9/3822

{Parallel decoding, e.g. parallel decode units}

Definition statement

This subgroup covers:

Decoding for enabling the parallel execution of instructions.

Special details of decoding multiple instructions in parallel, e.g. decoding of Very Long Instruction Word format field.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Compressed VLIW instructions	G06F 9/30156
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G06F 9/3824

{Operand accessing}

Definition statement

This subgroup covers:

Retrieving operands for instructions, from memory, registers, other pipeline stages or execution units.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Register file accessing in general	G06F 9/30098
Load, Store instructions	G06F 9/30043

Synonyms and Keywords

In patent documents the following expressions "input operand" and "source" are often used as synonyms.

In patent documents the following expressions "output operand", "result" and "destination" are often used as synonyms.

G06F 9/3826

{Data result bypassing, e.g. locally between pipeline stages, within a pipeline stage}

Definition statement

This subgroup covers:

Arrangements for the transfer of an instruction result to a dependent instruction, without first storing in the architected state, e.g. bypassing the register file;

Transfer of operand data from the output of a functional unit to the input of another functional unit, without waiting for the completion of the data producing instruction, or without waiting for the data to be stored in the register file.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Transfer of data between Store and Load instructions for memory consistency	G06F 9/3834
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Synonyms and Keywords

In patent documents the following expressions "bypassing" and "forwarding" are often used as synonyms.

G06F 9/3828

{with global bypass, e.g. between pipelines, between clusters}

Definition statement

This subgroup covers:

Bypass of an instruction result to a dependent instruction in another pipeline, or group of execution units, e.g. between clusters;

Bypass arrangements for global data.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Parallel execution units organised in clusters	G06F 9/3889
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Cluster	Group of execution units and register resources
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G06F 9/383

{Operand prefetching (cache prefetching [G06F 12/0862](#))}

Definition statement

This subgroup covers:

Prefetching of data operands;

Software data prefetching;

Prefetching from a data cache reduces cache misses during execution of the instruction using the data.

Relationship between large subject matter areas

Prefetching between higher level memories: [G06F 12/0862](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Specific instruction to prefetch data from memory	G06F 9/30047
Instruction prefetching	G06F 9/3802
Speculative load instructions	G06F 9/3842
Prefetching between higher level memories	G06F 12/0862

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Operand prefetching	Look-ahead fetching of an operand before the execution of the instruction which will use the operand
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G06F 9/3832

{Value prediction for operands; operand history buffers}

Definition statement

This subgroup covers:

Reuse or prediction of the value of an operand;

Operand value prediction using a history of the value of an operand;

Operand value buffering for reuse;

Prediction of the address of an operand.

Relationship between large subject matter areas

Data caches in general: [G06F 12/08](#).

G06F 9/3834

{Maintaining memory consistency (cache consistency protocols
[G06F 12/0815](#))}

Definition statement

This subgroup covers:

How to maintain memory consistency during operand accessing for instruction execution.

Avoiding errors caused by loads and/or stores to the same memory address being executed out of order or concurrently.

Ensuring stored operands and fetched operands are consistent, e.g. memory disambiguation.

Ensuring out-of-order loads receive the latest store information by forwarding.

Relationship between large subject matter areas

Cache consistency protocols: [G06F 12/0815](#).

Multiprogramming arrangements for transaction processing: [G06F 9/466](#).

Multiprogramming arrangements for program synchronisation: [G06F 9/52](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Consistency of architectural state	G06F 9/3857
Specific atomic or synchronisation instructions, e.g. Read-Modify-Write	G06F 9/30087 , G06F 9/3004
Operand bypassing between Load and Store instructions	G06F 9/3826
Cache consistency protocols	G06F 12/0815

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Memory consistency	Keeping data in the memory up-to-date. Read data should not be stale; written data should not be overwritten by older data, which may occur in out-of-order execution.
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Memory disambiguation	Checking stores against earlier executed out-of-order loads, and re-issuing the loads if their data is stale.
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G06F 9/3836

{Instruction issuing, e.g. dynamic instruction scheduling, out of order instruction execution}

Definition statement

This subgroup covers:

Runtime scheduling or issuing of instructions.

Instruction dispatching to execution units or execution buffers.

Concurrent execution of instructions.

Synchronisation of instruction execution.

Relationship between large subject matter areas

Runtime scheduling of tasks: [G06F 9/4806](#)

Informative references

Attention is drawn to the following places, which may be of interest for search:

Accessing of operands for issue	G06F 9/3824
Re-issuing of faulting instructions	G06F 9/3861

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Issuing	Runtime selection or scheduling of the instructions to execute.
Superscalar	Architecture where more than one instruction is selected to be executed in parallel in one cycle.
VLIW	Very Long Instruction Word being a compound instruction word formed by the compiler, containing multiple sub-instructions to be issued and completed together in one cycle

G06F 9/3838

{Dependency mechanisms, e.g. register scoreboarding}

Definition statement

This subgroup covers:

Special arrangements to detect or record data dependencies between instruction operands at issue time.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Data dependency	When a first instruction specifies an operand which is also specified in a following second instruction, the second instruction is dependent on the first, and cannot be executed until the dependency is resolved, or the operand is available.
Register scoreboard	Table of indicators of which instructions use which registers. May be used for dependency checking by detecting two instructions having a matching indicator.

Synonyms and Keywords

In patent documents the following expressions "Pseudo data dependency", "false data dependency", "anti-dependency", "write-after-write dependency" and "output dependency" are often used as synonyms.

G06F 9/384

{Register renaming}

Definition statement

This subgroup covers:

Special arrangements to carry out register renaming, e.g. as a means of avoiding pseudo dependencies;

Rename tables and buffer, which may form part of a reorder buffer.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Reorder buffers	G06F 9/3855
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Register renaming	Associating a logical register specified in an instruction to a unique physical register. Allows multiple physical registers to be assigned to hold data for multiple instances of a logical register, thus avoiding false dependencies. Relies on the set of physical registers being larger than the set of logical registers.
RAW, read-after-write dependency	Occurs when a read to the same location occurs after a write to the same location. If the instructions are not in program order, this may lead to wrong execution.
WAW, write-after-write dependency	It occurs when a write to the same location occurs after another write to the same location. If the instructions are not in program order, this may lead to wrong execution.
Pseudo data dependency, false dependency, anti-dependency, output dependency	Dependency which may be resolved without wrong execution, e.g. a write followed in program order by another write; a read followed in program order by a write.

Synonyms and Keywords

In patent documents the following expressions "RAW" and "read-after-write dependency" are often used as synonyms.

In patent documents the following expressions "WAW" and "write-after-write dependency" are often used as synonyms.

In patent documents the following expressions "pseudo data dependency", "false dependency", "anti-dependency", "output dependency" are often used as synonyms.

G06F 9/3842

{Speculative instruction execution}

Definition statement

This subgroup covers:

Execution of instructions ahead of program order, with the presumption that execution will prove to be correct e.g. speculative loads, boosting.

Speculative instructions which are executed e.g. alternative paths of a branch.
Execution of instructions dependent on a branch before its outcome is known.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Conditional instruction execution, e.g. predication	G06F 9/30072
Result nullification for executed instructions	G06F 9/3859
Recovery after mis-speculation	G06F 9/3861

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Speculative instructions	Executed instructions which may not be on the actual path taken through the program, and therefore may require recovery after execution if mis-speculation occurs.
Speculative loads	Look-ahead or early execution of load instructions, where recovery would be needed in the case of mis-speculation.

G06F 9/3844

{using dynamic prediction, e.g. branch history table}

Definition statement

This subgroup covers:

Speculative execution of instructions using dynamic branch prediction;

Using runtime conditions, and the previous behaviour of branches, to predict the outcome of a branch, without having to wait for its execution;

Early generation of branch results.

References relevant to classification in this group

This subgroup does not cover:

Using hybrid branch prediction	G06F 9/3848
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Dynamic prediction	Branch prediction based on runtime conditions, as opposed to compile-time branch prediction.
Branch history table	Branch prediction based on runtime conditions, as opposed to compile-time branch prediction.
Branch Target Buffer	Buffer indexed by an instruction fetch address or PC, which returns the predicted target address if the instruction is a taken branch
Branch History Table	Buffer indexed by a branch instruction address, which returns a prediction of whether the branch is taken or not.
Branch Decode Table	Buffer indexed by a branch type at decode time, which returns a prediction of whether the branch is taken or not.
Branch Prediction Counter	saturating counter used to obtain a weighting for a branch prediction based on several branch executions.

Synonyms and Keywords

In patent documents the following abbreviations are often used:

BTB	Branch Target Buffer
BHT	Branch History Table
BTAC	Branch Target Address Cache
BDT	Branch Decode Table

G06F 9/3846

{using static prediction, e.g. branch taken strategy}

Definition statement

This subgroup covers:

Speculative execution of instructions using static branch prediction;

Branch prediction performed by compiler, and not dependent on runtime conditions, e.g. hint bits;

Static bit may be used to indicate an unconditional branch, if this is not clear from the opcode;

Static prediction may be used as default when no dynamic prediction is available.

References relevant to classification in this group

This subgroup does not cover:

Using hybrid branch prediction	G06F 9/3848
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Static prediction	Branch direction is predicted based on compile-time branch prediction.
Hint bit	Bit in branch instruction inserted by compiler to give an indication whether branch predicted taken or not.

Synonyms and Keywords

In patent documents the following expressions "hint bit" and "static bit" are often used as synonyms.

G06F 9/3848

{using hybrid branch prediction, e.g. selection between prediction techniques}

Definition statement

This subgroup covers:

Prediction schemes involving more than one type of predictor;

Static and dynamic prediction used alternately;

Local and global prediction mechanisms;

Two-level branch prediction.

References relevant to classification in this group

This subgroup does not cover:

Using dynamic prediction, e.g. branch history table	G06F 9/3844
Using static prediction, e.g. branch taken strategy	G06F 9/3846

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Two-level branch prediction	History of the outcome of a set of branches is used to select the predictor for a particular branch.
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G06F 9/3851

{from multiple instruction streams, e.g. multistreaming (initiation or dispatching of multiple tasks or threads [G06F 9/48](#))}

Definition statement

This subgroup covers:

- Issuing instructions from multiple threads each having a context, including at least a program counter, and possibly registers and execution resources;
- Includes multiple streams for different threads, or from both directions of a branch;
- Interleaved execution of threads in a single or in multiple streams;
- Stream selection.

Relationship between large subject matter areas

Thread scheduling or multithreading at OS or application level [G06F 9/46](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Context registers for multiple streams	G06F 9/30123
Execution units or pipeline architectures for executing multiple streams	G06F 9/3889

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Instruction stream	Architectural aspects, e.g. resources and context, used to execute a thread or series of instructions. Includes at least a program counter, and possibly including dedicated instruction buffers, registers, status register, execution units.
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G06F 9/3853

{of compound instructions}

Definition statement

This subgroup covers:

Issuing of compound instructions;

Compounding single instructions into a group;

Issuing a group of instructions, that must complete in the same cycle;

Dispatching aspects of compound instructions, e.g. variable format VLIW instructions.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Decoding of VLIW format field	G06F 9/3822
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Compound instruction	Consisting of sub-instructions, i.e. contains multiple opcodes, e.g. VLIW instructions.
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G06F 9/3855

{Reordering, e.g. using a queue, age tags}

Definition statement

This subgroup covers:

Special arrangements for reordering of instructions issued out-of-order.

Usually occurs at writeback stage;

Queue arrangements include reorder buffers;

Age tags include marking the instructions with the original program order.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Reordering	Restoring the program order after instruction execution, ensuring that the instructions complete in the correct order.
Age tag	An indicator associated with an instruction to indicate its original program order, e.g. in the case of instructions executed out-of-order.

G06F 9/3857

{Result writeback, i.e. updating the architectural state}

Definition statement

This subgroup covers:

Special arrangements to write back results to the architectural state, ensuring correctness of the architectural state;

Instruction completion.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Recovery of architectural state after an exception	G06F 9/3861
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Architectural state	Runtime data in the pipeline resources, including program counter, instruction queue, status register, condition codes, general purpose and special purpose registers, rename data, pipeline registers, etc. The state is updated when one of these resources is written to.
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G06F 9/3859

{with result invalidation, e.g. nullification}

Definition statement

This subgroup covers:

Ensuring correctness of the architectural state by nullifying the results of wrongly executed instructions.

Nullifying may use, for example, preventing writeback; tagging the result as invalid; clearing of result.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Cancellation of an instruction before execution using, for example, predication	G06F 9/30072
Recovery from exceptions	G06F 9/3861

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Nullification	In this subgroup, the invalidation of an instruction result. The instruction has already executed, but the results are invalid, and must not update the architectural state.
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G06F 9/3861

{Recovery, e.g. branch miss-prediction, exception handling (error detection or correction [G06F 11/00](#))}

Definition statement

This subgroup covers:

Recovery of correct instruction execution after an exception or fault;

Restoring the correct architectural state after an exception, e.g. after branch mis-prediction, arithmetic overflow.

May require nullifying wrong results; flushing the instructions in the pipeline; restarting the pipeline from the point of exception.

Relationship between large subject matter areas

Error detection or correction: [G06F 11/00](#).

Exception handling in genera: [G06F 11/0793](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Instruction result nullification	G06F 9/3859
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Special rules of classification within this group

The group is only to be used for the handling of exceptions caused by instruction execution.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Architectural state	The runtime data in the pipeline resources, including program counter, instruction queue, status register, condition codes, general purpose and special purpose registers, rename data, pipeline registers etc.
Exception, fault	Error caused by the execution of an instruction, e.g. floating point overflow; page fault; mis-speculation.

G06F 9/3863

{using multiple copies of the architectural state, e.g. shadow registers}

Definition statement

This subgroup covers:

Recovery using multiple copies of architectural state;

Restoring the architectural state to that previous to an exception using a previous version of the state, e.g. checkpoint, future file, shadow registers.

Relationship between large subject matter areas

Software debugging: [G06F 11/36](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Shadow register structure	G06F 9/30116
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Special rules of classification within this group

The subgroup is only to be used for the handling of exceptions caused by instruction execution. In particular, checkpointing for software debugging is not meant.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Architectural state	the runtime data in the pipeline resources, including program counter, instruction queue, status register, condition codes, general purpose and special purpose registers, rename data, pipeline registers etc.
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G06F 9/3865

{using deferred exception handling, e.g. exception flags}

Definition statement

This subgroup covers:

Instruction exception handling which does not occur in the cycle in which the exception is detected, but later, e.g. at writeback stage.

G06F 9/3867

{using instruction pipelines}

Definition statement

This subgroup covers:

Concurrent execution using instruction pipelines;

Control of instructions moving through a pipeline of functional stages.
A typical pipeline consists of these stages: Instruction fetch; Instruction decode; Operand fetching; Instruction issue; Instruction execution; Instruction completion/Result writeback;

Pipeline control, e.g. flushing, halting;

Pipeline stages, e.g. type of stage, number of stages;

Variable length pipeline, e.g. elastic pipeline;

Counterflow pipeline;

Cascaded pipelines.

Relationship between large subject matter areas

Data-driven systems, e.g. tokens: [G06F 9/4436](#) .

Computer architectures for data-driven systems: [G06F 15/82](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Asynchronous pipeline control, e.g. using handshaking	G06F 9/3871
Specific instructions for pipeline control	G06F 9/30079

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Pipeline	Series of linearly sequential execution stages for executing instructions. The stages have buffers between them for output data which is input into the next stage. The buffers may be clocked so that data from one stage moves into the next stage on a clock signal. All stages move at once, else an asynchronous pipeline.
Counterflow pipeline	Pipeline in which instructions travel down pipeline, but data travels up pipeline.
Cascaded pipeline	Parallel pipelines where a group of instructions are issued in successive cycles to produce a staggered execution of the group.

G06F 9/3869

{Implementation aspects, e.g. pipeline latches; pipeline synchronisation and clocking}

Definition statement

This subgroup covers:

Instruction pipeline synchronisation;

Timing aspects of instruction pipelines, e.g. clock cycle, derating;

Clocking of pipeline stages; clock domains;

Clock skew problems;

Clock gating in pipelines, e.g. for power saving;

Latches and buffers between pipelines stages.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Specific instructions for pipeline control.	G06F 9/30079
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Clock skew	lack of synchronicity between instances of a clock signal caused, e.g. by differing clock wire lengths.
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G06F 9/3871

{Asynchronous instruction pipeline, e.g. using handshake signals between stages}

Definition statement

This subgroup covers:

Asynchronous pipeline, e.g. using handshake signals between stages, e.g. ACK, DONE signals.

Pipelines where the stages do not all move at the same time.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Asynchronous pipeline	Pipeline where not all stages move at once, e.g. execution in a stage starts when a signal is received from previous stage, and ends by sending a done signal to next stage.
Handshake signals	Exchange of signals between stages, e.g. to inform a next stage when data is available to process, and to inform a previous stage when data may be forwarded.

G06F 9/3873

{Variable length pipelines, e.g. elastic pipeline}

Definition statement

This subgroup covers:

Pipeline with dynamically varying length.

Multiple pipelines having different lengths.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Pipeline length	The number of pipeline stages.
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G06F 9/3875

{Pipelining a single stage, e.g. superpipelining}

Definition statement

This subgroup covers:

Pipeline architecture where a single stage is split into sub-stages using pipeline buffer, with higher clocking rate implied for that stage, e.g. pipelined execution unit; pipelined decode unit.

Pipeline architecture having multiple stages for the same function, e.g. two execution stages, without higher clock rate.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Pipelined decoding	G06F 9/382
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G06F 9/3877

{using a slave processor, e.g. coprocessor (peripheral processor [G06F 13/12](#); vector processor [G06F 15/8053](#))}

Definition statement

This subgroup covers:

Concurrent instruction execution using slave processor or coprocessor which controls its own execution i.e. has a decode unit or sequencer;

Means and protocol to transfer instructions and data to a slave processor, and to receive results in return;

Detection of presence or absence of a slave processor;

Reconfigurable coprocessors i.e. not special purpose.

Relationship between large subject matter areas

Vector processors: [G06F](#), [G06F 15/8053](#).

Cryptographic processors: [G06F 21/123](#) .

I/O or DMA processors: [G06F 13/12](#).

Image or graphics processors: [G06T 1/20](#).

Specially adapted processors: [G06F 17/00](#), [G06F 19/00](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Execution units executing under control of a master decoder	G06F 9/3885
Peripheral processor	G06F 13/12
Vector processor	G06F 15/8053

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Host	master processor to which the coprocessor is a slave
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Synonyms and Keywords

In patent documents the following expressions/words "COP" and "coprocessor" are often used as synonyms.

G06F 9/3879

{for non-native instruction execution, e.g. executing a command; for Java instruction set}

Definition statement

This subgroup covers:

Slave processors which receive and decode instructions which are not explicit in the instruction set of the host e.g. commands; function calls; using ESC; using memory-mapped commands;

Slave processors which are adapted to execute another instruction set, e.g. Java coprocessor.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Non-native instruction set	Instructions which cannot be executed on the master processor
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G06F 9/3881

{Arrangements for communication of instructions and data}

Definition statement

This subgroup covers:

Special arrangements or protocols for transfer of instructions or commands, and for exchange of data with a slave processor which executes non-native instructions.

G06F 9/3885

{using a plurality of independent parallel functional units}

Definition statement

This subgroup covers:

Special arrangements for concurrent instruction execution using parallel functional units, implying the concurrent execution of multiple instructions, one in each of the functional units;

Parallel execution pipelines.

Relationship between large subject matter areas

Arrays of processors [G06F 15/78](#), [G06F 15/80](#), [G06F 15/16](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Parallel decode units	G06F 9/3822
Concurrent execution using a slave processor	G06F 9/3877

Special rules of classification within this group

This group is only to be used for special architectural arrangements to enable the concurrent execution of instructions, not for the mere presence of parallel functional units.

Parallel functional units does not usually mean parallel processors. Multicore architectures may be found here only if they carry out concurrent execution of instructions from the same program.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Functional unit	Unit within the processor which carries out part of the execution of an instruction.
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G06F 9/3887

{controlled by a single instruction, e.g. SIMD}

Definition statement

This subgroup covers:

Multiple parallel functional units controlled by a single instruction.

For SIMD execution, this class contains details relevant to the execution aspects, e.g. executing a global instruction according to local conditions.

Relationship between large subject matter areas

SIMD architectures : [G06F 15/80](#).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

SIMD	Acronym for "single instruction multiple data" being an architecture having a set of homogenous execution units which execute the same instruction in any given cycle, but which each have their own operand data, e.g. vector data.
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G06F 9/3889

{controlled by multiple instructions, e.g. MIMD, decoupled access or execute}

Definition statement

This subgroup covers:

Multiple parallel functional units controlled collectively by multiple instructions.

Includes special techniques of parallel functional unit control in a superscalar or VLIW architecture.

Hardware streams.

Relationship between large subject matter areas

MIMD architectures: [G06F 15/16](#).

Special rules of classification within this group

This group is only to be used for special architectural arrangements to enable the concurrent execution of instructions, not for the mere presence of parallel functional units executing multiple instructions.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

MIMD	Acronym for "multiple instruction multiple data" being an architecture having a set of homogenous execution units which execute different instructions in any given cycle, and which each have their own operand data.
VLIW	Acronym for "very long instruction word" being an architecture having a compound instruction word formed by the compiler, containing multiple sub-instructions to be issued and completed together in one cycle, and having no interdependencies.
Hardware stream	Hardware resources used for the context and execution of a stream or thread of instructions.

G06F 9/3891

{organised in groups of units sharing resources, e.g. clusters}

Definition statement

This subgroup covers:

Control of parallel execution by groups of functional units, such as multiple execution units sharing local memory;

Partitioned architectures, e.g. for hardware multistreaming.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Cluster	Group of execution units with shared register resources.
Hardware stream	Hardware resources used for the context and execution of a stream or thread of instructions.

G06F 9/3893

{controlled in tandem, e.g. multiplier-accumulator}

Definition statement

This subgroup covers:

Multiple functional units which are controlled in tandem or cascade to carry out an instruction.

Multiple functional units controlled by the same instruction but not in the same cycle.

Relationship between large subject matter areas

Hierarchical adders: [G06F 7/50](#).

Synonyms and Keywords

In patent documents the following abbreviations are often used.

MAC	Multiplier-accumulator unit
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G06F 9/3895

{for complex operations, e.g. multidimensional or interleaved address generators, macros}

Definition statement

This subgroup covers:

Multiple functional units which are controlled in tandem or cascade to carry out an instruction which is a complex operation, possibly over multiple cycles.

G06F 9/3897

{with adaptable data path}

Definition statement

This subgroup covers:

Parallel functional units controlled in tandem to execute complex operations using adaptable datapath.

Relationship between large subject matter areas

Reconfigurable computer architectures: [G06F 15/7867](#).

G06F 9/44

Arrangements for executing specific programmes

Definition statement

This subgroup covers:

Execution of a single program.

References relevant to classification in this group

This subgroup does not cover:

Program initiating or program switching in the context of multiprogramming	G06F 9/48
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

High level language	refers to what is commonly known in the art, i.e. a language containing human readable constructs intended to be used by a human programmer and to be translated to binary code for execution. The fact that it is theoretically possible to read, understand and directly program binary code does not qualify this type of code as HLL.
Low-level language	language that provides little or no abstraction from a computer's instruction set architecture

Synonyms and Keywords

In patent documents the following abbreviations are often used:

HLL	High level language
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G06F 9/4401

{Bootstrapping (secure booting [G06F 21/575](#); fault tolerant booting [G06F 11/1417](#); resetting means [G06F 1/24](#); power-on self test [G06F 11/2284](#))}

Definition statement

This subgroup covers:

Starting up or shutting down a computer system and loading of the operating system:

Using memory images to boot;

Boot using compressed bios;

Starting jobs after loading os;

Manual booting procedures;

Bootstrap code, e.g. grub, lilo;

Primary and secondary boot loader.

References relevant to classification in this group

This subgroup does not cover:

Compiler bootstrapping	G06F 8/37
Low level details of resetting means	G06F 1/24
Details of Power-On Self Test (POST)	G06F 11/2284
Fault tolerant booting	G06F 11/1417
Secure booting	G06F 21/575

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

For set top boxes	H04N 21/443
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Bootstrap	a simple program that begins initialization of the computer's operating system
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Synonyms and Keywords

In patent documents the following abbreviations are often used:

IPL	Initial program load
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G06F 9/4403

{Processor initialisation}

Definition statement

This subgroup covers:

Initialisation of the processor and the processor's direct environment immediately after the initial reset signal.

This group deals with local issues - there is no network involved.

Includes:

- Initial microcode loading;
- Selecting the very first instructions to be executed after a hardware reset;
- Processor address boot facilities;
- I/O channel initialisation (see also [G06F 9/4416](#));
- Making BIOS ROM invisible after booting;
- Means to shadow BIOS from ROM to (faster) RAM.

References relevant to classification in this group

This subgroup does not cover:

Configuring of multiprocessors	G06F 15/177
Loading microcode per se	G06F 9/24

G06F 9/4405

{Initialisation of multiprocessor systems}

Definition statement

This subgroup covers:

Initialisation of processors in a multiprocessor system immediately after the initial reset signal.

References relevant to classification in this group

This subgroup does not cover:

Configuring of multiprocessors	G06F 15/177
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G06F 9/4406

{Loading of operating system}

Definition statement

This subgroup covers:

Loading of the operating system and the preparatory steps for loading the OS.

Also includes the launching of application programs once the OS has been loaded, and OS formats on storage devices.

G06F 9/4408

{Boot device selection}

Definition statement

This subgroup covers:

Searching and selecting a bootable boot device.

G06F 9/441

{Multiboot arrangements, i.e. selecting an operating system to be loaded}

Definition statement

This subgroup covers:

Computer systems having more than one bootable OS

- Choosing one of the available bootable OSs and booting from that OS (dual-boot or multi-boot);
- Providing mechanical means to switch between the OSs (see US2006107029);
- When a computer is switched on for the first time, the user is required to choose one of the OSs available on the computer. Once an OS is chosen, the other OSs are made unavailable. The next time the computer is started, it will boot only the selected OS (see EP0794484).

References relevant to classification in this group

This subgroup does not cover:

When one of this plurality of OSs serves as a backup OS in case of failure, recovery OS	G06F 11/00
Two active OSs, where one OS (the guest OS) is running as an application in the other OS (the host OS)	G06F 9/45545
Emulating one OS using another	G06F 9/45504

Multiple OSs running simultaneously in the context of a VMM	G09F6/455H
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G06F 9/4411

{Configuring for operating with peripheral devices; Loading of device drivers}

Definition statement

This subgroup covers:

Initialisation and configuration of peripheral devices, insofar as this configuration is related to the interaction with the operating system.

Also deals with the configuration of the operating system in order to be able to interact with peripheral devices.

A peripheral device in this class should be understood as a passive entity, i.e. whose functioning is controlled by the host computer to which it is attached. Systems involving a host computer with attached devices that have processing capabilities of their own should be treated as a multiprocessor or a networked distributed system.

This initialisation/configuration does not have to occur during booting (although it typically does) - it can also take place e.g. when a device is hot-inserted (plug and play).

This group deals with local issues - there is no network involved.

- Assigning IRQ lines, I/O addresses;
- Configuring registers on the peripheral;
- Device discovery: detecting which devices are present; building device trees;
- Adapting OS for device configuration;
- Device initialisation;
- Config.sys peripheral device facilities.

Loading or installation of device drivers. This does not necessarily have to occur at boot time.

References relevant to classification in this group

This subgroup does not cover:

Loading/installing device drivers	G06F 9/4411
Configuring software or OS when this configuration is not related to interacting with the peripheral device	G06F 9/44505

Management of devices over a network	H04L 67/125 H04L 67/025
Configuration of printer parameters	G06F 3/1297
Updating of firmware in peripheral devices	G06F 8/65

Informative references

Attention is drawn to the following places, which may be of interest for search:

Reconfiguration of FPGAs, PLDs	G06F 17/5054
Electrical details of hot-plugging, plug and play	G06F 13/4081
HAVi networks	H04L 12/2803
Program control for peripheral devices - the inner workings of a device driver, i.e. how the driver performs its job of interfacing between OS & device, how the driver is structured, etc.	G06F 13/102
Peripherals with a processor and software running thereon together with the computer's processor can be considered a multiprocessor system. A distinction has to be made between the device driver - i.e. the software that runs on the host to interface with the peripheral - and the software running on the peripheral.	G06F 15/177
Configuration of network elements	H04L 41/0803

Special rules of classification within this group

A device driver is understood to be software used by a computer to control/operate a peripheral device. A peripheral is any kind of device that can be attached to/inserted into a computer in order to expand its functionality (modem, sound card, disk drives). A device driver- i.e. the piece of software that is loaded on a host computer and that enables the host computer to control the operation of an attached peripheral - differs from the peripheral's operating software - i.e. the piece of software that resides on the peripheral itself and executed by the peripheral's processor that allows the peripheral to operate as an independent unit.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Peripheral Internal	an expansion card that is plugged into one of the ISA/PCI slots
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Peripheral External	an external device connected through the serial/parallel port a PC card
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G06F 9/4413

{Plug-and-play (PnP)}

Definition statement

This subgroup covers:

Arrangements for automating the process of device driver loading or configuration of a peripheral device or the operating environment of the computing element hosting the peripheral device in response to dynamic changes in the peripheral constitution of the computing element (addition or removal of peripheral devices).

Plug-and-play in the context of this class occurs either during boot time or during run-time (live addition or removal).

G06F 9/4415

{Self describing peripheral devices}

Definition statement

This subgroup covers:

The peripheral device itself contains all the information (or a reference to a place where the information is stored) required for its configuration and the configuration of the operating environment. In other words, it is the peripheral device and not the operating environment that is burdened with the task of providing configuration information or device drivers.

G06F 9/4416

{Network booting; Remote initial programme loading [RIPL]}

Definition statement

This subgroup covers:

Bootting of client computers, processors or devices that do not have the necessary boot code locally available but retrieve the boot code from a remote source, e.g. a boot server in a network environment.

Specific topics included:

- Booting of diskless computers ("net" computers);
- "Push" booting: a server computer boots a client computer by sending a boot program to the client computer;

- PXE (Preboot Execution Environment)

The Preboot Execution Environment (PXE) is an industry standard client/server interface that allows networked computers that are not yet loaded with an operating system to be configured and booted remotely by an administrator. The PXE process consists of the client notifying the server that it uses PXE. If the server uses PXE, it sends the client a list of boot servers that contain the operating systems available. The client finds the boot server it needs and receives the name of the file to download. The client then downloads the file using Trivial File Transfer Protocol and executes it, which loads the operating system.

- Booting a thin client in a "client device/data center" environment (see US2006/161765);
- Network booting;
- Booting diskless workstations;
- Booting thin clients.

References relevant to classification in this group

This subgroup does not cover:

Booting of multiprocessor systems, e.g. where one processor (the master) sends the boot or initialisation code to the other processors (slaves)	G06F 15/177
Network protocols involving booting	H04L 67/34
BOOTP, DHCP protocol	H04L 61/2023 , H04L 61/2015 , H04L 61/2023

Informative references

Attention is drawn to the following places, which may be of interest for search:

Wake-on-LAN (WoL)	H04L 12/12
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Special rules of classification within this group

Remote booting in the context of a first-time and one-off installation of an OS is also classified in the [G06F 8/61](#).

Examples: US5758165, US5717930, US6151674.

Synonyms and Keywords

In patent documents the following abbreviations are often used:

RIPL	Remote Initial Program Load
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PXE	Preboot Execution Environment
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G06F 9/4418

{Suspend and resume; Hibernate and awake}

Definition statement

This subgroup covers:

Suspend/Resume and Hibernate/Wake Up refer to techniques to put a system in a low power, non-operating mode, thereby preserving the system state that existed at the time of going into Suspend or Hibernate. The next time the computer is started, operation continues at the point where it left off, rather than starting from scratch.

- Speeding up the boot process by restoring persisted data from previous executions rather than going to the whole boot process.
- Hibernating a system to persistent storage on a first computer, transporting the storage to a second computer and resuming the execution there. Please note that this is not process migration.
- Multiple removable storage devices, each having a different hibernated system image stored thereon; resuming the different system images on one computer by switching the storage devices (see e.g. US5680540, EP0498374, XP13105759).
- Quickly bringing a computer into an operational state by copying a memory image from persistent storage to RAM, thereby bypassing the lengthy conventional boot process (see e.g. US2005/0240755).

References relevant to classification in this group

This subgroup does not cover:

Suspending a running process and resuming its execution later in the context of process scheduling	G06F 9/461 G06F 9/4881
Saving operational state of running applications when unexpected shutdown events occur	G06F 11/1441
Power Management	G06F 1/3203
Wake-on-LAN	H04L 12/12
Normal Shutdown (without saving state information - the next boot starts from scratch)	G06F 9/4401
Low-level, electrical details of suspend and resume	G06F 1/32

Informative references

Attention is drawn to the following places, which may be of interest for search:

Graceful shutdownWhen a power failure is detected, an emergency power supply (e.g. UPS) is activated giving the system enough time to do a proper shutdown (when shutting down a computer system, no state information is saved).Graceful hibernation.When a power failure is detected, an emergency power supply (e.g. UPS) is activated giving the system enough time to do a proper hibernation (thereby saving the system state) before eventually powering down.Dealing with power failures that occur when the system is in suspend mode, i.e. when the RAM is still powered;In battery-powered systems, suspending or hibernating the system when the battery level drops below a predetermined level	G06F 11/1441
Booting a computer system when an error/ fault is involved. Includes Dealing with errors that occur during the boot process itself (e.g. when encountering a corrupt BIOS); * Rebooting the system after a previous irregular shutdown (e.g. due to a power failure), thereby restoring as much as possible the system state that existed before the irregular shutdown occurred.In absence of an emergency power supply, a power failure will cause the computer system to be simply powered down, inevitably resulting in the loss of system state. The next time the computer is booted, the system state will be restored as much as possible.	G06F 11/1417

Special rules of classification within this group

The techniques of Suspension and Hibernation differ from each other in the degree of persistency of saving the system state.

With Hibernation, the system state is stored on a non-volatile memory device, e.g. HDD, while in the case of Suspension, the system state is stored in volatile memory (e.g. RAM).

In the [G06F 9/4418](#) we only deal with situations where the reason or the system to suspend or hibernate is controlled/intentional e.g. after user presses power off button, after a preset period of inactivity for power saving purposes. When the reason to suspend or hibernate is the occurrence of a power failure, low battery voltage or another anomaly (e.g. system hang), then the document should go to the [G06F 11/1441](#) (see Related Fields). The subsequent restart of the is classified in the [G06F 11/1417](#).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Hibernation	also known as Suspend-to-Disk (S2D) and is defined as sleeping mode S4 in the ACPI specification.
Suspension	also known as Suspend-to-RAM (STR) and is defined as sleeping mode S3 in the ACPI specification.

G06F 9/442

{Shutdown}

Definition statement

This subgroup covers:

Shutting down the computer, the opposite operation of bootstrapping ([G06F 9/442](#)).

References relevant to classification in this group

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Suspend and resume	G06F 9/4418
Graceful shutdown in case of power failure, e.g. using an uninterruptible power supply (UPS)	G06F 11/1441

G06F 9/4421

{Execution paradigms}

Definition statement

This subgroup covers:

Specific paradigms to execute computer programs, e.g. object-orientated methodology, finite state machine model.

G06F 9/4425

{Executing sub-programmes}

Definition statement

This subgroup covers:

Invocation and execution of subroutines, for example:

- Implementation of a call stack: creating and deleting activation records, reserving space on the stack to store local variables and to pass the arguments;
- Argument passing;
- Locating variables at higher level in the invocation chain;
- Co-routines;
- Re-entrant functions;
- Function or method overloading: considering the type of all actual arguments/return type of a function to select a proper function instance to execute: us5488727, us2004210870, us6415434;
- Calling functions in another programming language.

Also covered are other combinations of several instructions, for example combinations of instructions to perform (counted) loops.

References relevant to classification in this group

This subgroup does not cover:

Remote procedure calls (RPC)	G06F 9/547
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Stack caching	G06F 12/0875
Hardware implementation of instructions that change the program flow to another address (jumps, branches, goto)	G06F 9/30

Synonyms and Keywords

In patent documents the following abbreviations are often used:

Sub-programs	subroutines, functions, procedures, object oriented methods
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G06F 9/4426

{Formation of sub-programme jump address}

Definition statement

This subgroup covers:

Finding the entry address of a subroutine and how to preserve the return address.

References relevant to classification in this group

This subgroup does not cover:

Hardware implementation of instructions specifically designed to keep the return address (e.g. branch-and-link, jsr)	G06F 9/30
Branch prediction in a pipelined system	G06F 9/3844 , G06F 9/3846
Dynamic linking, i.e. at or after load-time	G06F 9/44521
Static linking, i.e. before load-time	G06F 8/54

G06F 9/4428

{Object-oriented}

Definition statement

This subgroup covers:

Execution aspects of object-oriented programs.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

OO	Object-Oriented
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G06F 9/443

{Object-oriented method invocation or resolution}

Definition statement

This subgroup covers:

Object-oriented method resolution, i.e. given a method invocation on a reference (pointer) to an object, how to locate the correct code that implements this method. Typically this is done using virtual function tables.

only deals with the resolution of an OO method. The subsequent actual execution of the method is covered by [G06F 9/44](#).

References relevant to classification in this group

This subgroup does not cover:

Remote method invocation (RMI)	G06F 9/548
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G06F 9/4431

{Optimising based on receiver type}

Definition statement

This subgroup covers:

Speeding up the run-time OO method resolution by predicting the type of the referenced object.

Synonyms and Keywords

In patent documents the following abbreviations are often used:

PIC	Polymorphic inline cache
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G06F 9/4433

{Inheritance}

Definition statement

This subgroup covers:

Object oriented class hierarchies. Includes run-time addition of classes to a hierarchy and/or virtual inheritance polymorphism.

References relevant to classification in this group

This subgroup does not cover:

Object-oriented method resolution	G06F 9/443
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Special rules of classification within this group

Documents in the [G06F 9/443](#) deal with OO method invocation and will inevitably talk about class hierarchies, which is the subject of [G06F 9/4433](#). However, this alone does not justify classification in [G06F 9/4433](#): only when the document gives specific details about class hierarchies, classification in [G06F 9/4433](#) should be given.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Method overriding	subclass provides a specific implementation of a method that is already provided by one of its superclasses
Polymorphism	creating a variable, a method or an object that has more than one form

G06F 9/4435

{Object persistence}

Definition statement

This subgroup covers:

Making objects persistent and restoring objects from persisted form.

Includes:

- Pointer swizzling;
- Flattening objects.

References relevant to classification in this group

This subgroup does not cover:

Serialization in the context of RPC, RMI	G06F 9/547 , G06F 9/548
OO databases	G06F 17/3061

G06F 9/4436

{Data-driven}

Definition statement

This subgroup covers:

Deals with software aspects of data driven systems, i.e. systems where the action is dictated by the presence or availability of data at the inputs of the logical circuits, rather than by sequential instruction execution under supervision of a central clock.

References relevant to classification in this group

This subgroup does not cover:

Architectures for data or demand driven systems	G06F 15/82
Data flow analysis during compilation	G06F 8/433
Specification Techniques, e.g. Petri nets	G06F 8/10

G06F 9/4443

{Execution mechanisms for user interfaces}

Definition statement

This subgroup covers:

Inner working of the GUI (e.g. from the programmatic point of view, interaction with the rest of the application/OS);

Architecture of a GUI;

GUI macros;

GUI (software execution aspect) for operating systems, e.g. Windows, MacOS, iOS.

References relevant to classification in this group

This subgroup does not cover:

Documents describing methods for a user to interact with the GUI (e.g. scrolling, drag and drop, menus).	G06F 3/048
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Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

User interfaces for testing or debugging software	G06F 11/36
User interface for databases, visualization of query results	G06F 17/30002 , G06F 17/30716
User interfaces to web services	G06F 17/3089 , G06F 17/30899
User interfaces for the field of automation	G05B 19/00

There are many other groups containing devices with a GUI, e.g. mobile phones, car navigation system, etc.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Gesture-based interaction, e.g. based on a set of recognized hand gestures	G06F 3/017
Character input methods	G06F 3/0233

Special rules of classification within this group

The mere presence of a GUI, without special features, in an application which normally would have been searched / classified somewhere else, should not be sufficient for belonging to this class. Also the existence of user interaction in the GUI might suggest that it should be classified in [G06F 3/048](#) and subclasses.

Common practice is to classify documents in this class only if they cannot be classified in any other classes, e.g. [G06F 3/00](#) or [G06F 17/00](#).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

User interface	the space where interaction between humans and machine occurs
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Synonyms and Keywords

In patent documents the following abbreviations are often used:

HCI	Human-computer interaction
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MMI	Man-machine interaction
CHI	Computer-human interaction
GUI	Graphical user interface

G06F 9/4445

{Remote windowing , e.g. X-Window System, desktop virtualisation (protocols for telewriting [H04L 67/38](#))}

Definition statement

This subgroup covers:

Methods to execute and interact with an application, whereby the application's program code runs on the server, and the GUI runs on the client (terminal). The user interacts with the remotely running application through the local GUI. GUI events/commands run back and forth between client and server. All processing is done at the server.

References relevant to classification in this group

This subgroup does not cover:

Terminal emulation	G06F 13/107
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Protocols for telewriting	H04L 29/06034 H04L 67/38
Communication between two running processes	G06F 9/54

G06F 9/4446

{Help systems}

Definition statement

This subgroup covers:

Customizing the help according to the user's previous actions;

Getting help by pressing f1;

Wizards, application assistants, visual cues;

Online tutorials.

References relevant to classification in this group

This subgroup does not cover:

Teaching appliances; GUIs specially adapted for deaf, mute or blind persons	G09B
Intelligent code editors	G06F 8/33

G06F 9/4448

{Multi-language systems; Localisation; Internationalisation}

Definition statement

This subgroup covers:

User interfaces in multiple human languages, adapting user interfaces to suit a foreign culture;

Game localization.

References relevant to classification in this group

This subgroup does not cover:

Pseudolocalization	G06F 11/00
Natural language translation	G06F 17/28

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Language localization	internationalization (i18n), globalization
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G06F 9/445

Programme loading or initiating {(bootstrapping [G06F 9/4401](#); movement of software or configuration parameters for network-specific applications [H04L 67/34](#))}

Definition statement

This subgroup covers:

Preparing a program for execution, including the actual launching of the program. This class does not deal with the actual execution of the program.

Deals with program loading, i.e. transferring program code from a storage location where it can not be directly executed by the processor (typically HDD,

floppy drive, but it may also be volatile memory of an other processor) to a location from where it can be directly executed by a processor (typically RAM):

- Load program code from an internal source (e.g. HDD) into RAM loading of DLLs;
- Absolute and relocating loaders;
- Relocation of program code;
- "Push loading": client sends program code to server, server executes the code and sends the results back to the client;
- Rearranging the physical layout of the program code installed on secondary storage in order to improve program launch/loading (WO2007056364, US5857101, US6658648, US5933630, WO9953395).

References relevant to classification in this group

This subgroup does not cover:

Process Migration	G06F 9/4856 , G06F 9/5088
Secure loading	G06F 21/51
Loading of device drivers	G06F 9/4411

Informative references

Attention is drawn to the following places, which may be of interest for search:

Protocols for network applications involving the movement of software and/or configuration parameters, e.g. applets	H04L 67/34
Loading of microcode	G06F 9/24
Bootstrapping	G06F 9/4401

G06F 9/44505

{Configuring for programme initiating, e.g. using registry, configuration files}

Definition statement

This subgroup covers:

Run-time configuration of software and computer applications, for example:

Configuring the Windows registry;

User profiles: roaming (i.e. restoring the user's settings at a different computer), multiple users (i.e. each user has a different profile).

References relevant to classification in this group

This subgroup does not cover:

Configuration management in the context of software development	G06F 8/71
Configuration of peripheral devices	G06F 9/4411
Configuration of FPGA, PLA	G06F 17/50
Configuration of parameters specifically aimed at networking/communication	H04L 12/2424

Informative references

Attention is drawn to the following places, which may be of interest for search:

Protocols for network applications involving terminal/user profiles	H04L 67/306
Configuration of the network and network elements	H04L 41/0803
Differentially changing configuration parameters	H04L12/08C
Gaming configure	G07F
Personalization of smart cards	G07F 7/10

Special rules of classification within this group

Configuration wizards that assist a user in configuring a software application, are also classified in [G06F 9/4446](#) (Help systems).

G06F 9/44521

{Dynamic linking or loading; Link editing at or after load time; e.g. Java class loading}

Definition statement

This subgroup covers:

Ways to load program code whereby, rather than first loading the entire program code before starting execution, the program code is loaded only when needed.

Also includes:

- Saving memory space and preventing unnecessary processing by only loading the program parts that are actually used; Parts that are never executed are never loaded;
- Starting execution once certain parts are loaded: no need to wait for the whole program to be loaded;
- Executing instructions as they are loaded: the idea of streaming;
- Java constant pool resolution
- Dynamic linking/loading is also known as: incremental, partial, run-time, lazy; on-demand linking/loading.

Synonyms and Keywords

In patent documents the following abbreviations are often used:

DLLs	Dynamic Link Library
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G06F 9/44526

{Plug-ins; Add-ons}

Definition statement

This subgroup covers:

Dynamically loading special software components to existing applications in order to extend their functionality, e.g. Adobe Flash-Player.

G06F 9/44536

{Selecting among different versions}

Definition statement

This subgroup covers:

Determining the right version of a software component to be loaded.

G06F 9/44542

{Retargetable}

Definition statement

This subgroup covers:

Program loading explicitly taking into account hardware characteristics of the target.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Retargetable program installation/update	G06F 8/64
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G06F 9/44547

{Fat binaries}

Definition statement

This subgroup covers:

Computer programs containing code native to multiple instruction sets (processor architectures).

G06F 9/44557

{Code layout in executable memory}

Definition statement

This subgroup covers:

How software components should be placed in a RAM, e.g. occupying neighbouring sections.

G06F 9/44573

{Execute-in-place [XIP]}

Definition statement

This subgroup covers:

Skipping or reducing the step of loading and initialization of program code.

Techniques used:

- XIP: eXecute-In-Place: execute programs from where they are persistently stored. There is no program loading.
- Pre-initialise modules: program code may be loaded, but it is already partially or totally initialised
- Romization of program code

XIP (Execute In Place) refers to the execution program code directly from the memory where it is stored, without first loading the program code to volatile executable memory (RAM).

Where the [G06F 9/445](#) relates to the preparatory process of making program code ready for execution - loading, i.e. transferring the code to executable

memory; linking, i.e. resolving references; initializing data structures - XIP relates to methods where the program code can be directly executed without having to go through this preparatory process.

One definition of XIP, taken from US2002/069342: "A XIP architecture is defined by a system's ability to execute one or more bytes of code while still resident within non-volatile memory (e.g., read-only memory (ROM)), without first transferring the code to volatile memory (e.g., random access memory (RAM))."

Another definition of XIP, taken from US2004/193864: "A called execute-in-place (XIP) technology refers to a specific function provided with a storage device, which data or command codes stored in the storage device can be directly accessed by a central processing unit (CPU) in a computer system, without pass through a random access memory (RAM), thus reducing power consumption and data loss, and increasing executing speed."

For program code to be directly executable from the memory where it is stored, it is required that the memory is suitable to directly execute code (read US2002/138702, [0004]-[0008]), and that the code is in such a form that it can be directly executed.

Examples of XIP:

- In normal computer systems, directly executing program code from an externally connected memory device;
- In embedded systems, executing the software directly from the non-volatile memory where it is stored.

Also included:

- Romization, romizer: processes and tools to generate a directly-executable program image.
- Semi-directly-executable code: the code is partially prepared for execution, the rest takes place at load time.

Special rules of classification within this group

The U3 technology does not fall under the XIP technology, because the program code is not executed directly from the USB stick.

G06F 9/44584

{Portable applications, i.e. making applications self-contained, e.g. U3 standard}

Definition statement

This subgroup covers:

Executing applications without installing them before, for example according to the U3 standard, or portable application packages ("Portable App") started directly from a USB stick.

G06F 9/44589

{Programme code verification, e.g. Java bytecode verification, proof-carrying code (high-level semantic checks [G06F 8/43](#); testing and debugging software [G06F 11/36](#))}

Definition statement

This subgroup covers:

Verification of program code, for example:

Java bytecode verification.

Proof carrying code.

inter instruction consistency checks.

References relevant to classification in this group

This subgroup does not cover:

High-level semantic checks	G06F 8/436
Testing and debugging software	G06F 11/36

Informative references

Attention is drawn to the following places, which may be of interest for search:

Testing	G06F 11/36
Software testing	G06F 11/36
Compile-time checking	G06F 8/43
Certifying or maintaining trusted computer platforms	G06F 21/57

Special rules of classification within this group

- In the [G06F 11/36](#) group, the question is: does the program do what it is expected to do? In other words, for a given input, does the program produce the expected output? The program is considered as a black box, only the external behaviour is studied. The tests that are performed do not take into account the implementation or the language that is used to write the program. We are here on the level of users/ developers/specifications.
- In the [G06F 9/44589](#), a test is performed to see whether the (compiled) program code does not do anything that is not allowed by the rules of the target machine. In other words, the question is: does the program comply with code specific requirements ?

The two groups are on a different level. It is possible for a program to respect all code specific requirements and thus to pass the [G06F 9/44589](#) tests, but not to produce the expected output and thus not to pass the [G06F 11/36](#) test.

- In the [G06F 8/43](#) (Compile-time checking), source code is checked. In most cases, this is done by the compiler but it can also be performed by a separate program. In contrast, the [G06F 9/44589](#) tests already compiled code. In the [G06F 8/43](#), the verification is performed based on source code specific aspects, whereas in the [G06F 9/44589](#) this is done on the basis of target machine related aspects

G06F 9/44594

{Unloading}

Definition statement

This subgroup covers:

- Unloading program components from memory or terminating applications, e.g. when they are not needed anymore.
- Java class unloading: removing Java classes from memory when they are not used anymore, e.g. because the class has become "unreachable".

Class unloading is not the same as Garbage Collection: in class unloading, what is removed is program code in executable memory (classes), whereas in Garbage Collection it is data (objects, i.e. class instances) that are removed.

References relevant to classification in this group

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Garbage collection	G06F 12/0253
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Uninstallation	G06F 8/62
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G06F 9/455

Emulation; Software simulation {, i.e. virtualisation or emulation of application or operating system execution engines (instruction translation at instruction execution time [G06F 9/3017](#); multiprogramming in general [G06F 9/46](#); logical partitioning of resources or management or configuration of virtualized resources [G06F 9/5077](#); in-circuit emulation [G06F 11/3652](#); environments for testing or debugging software [G06F 11/3664](#))}

Definition statement

This subgroup covers:

The emulation (see glossary) of entities, e.g. operating systems, processors, classified under [G06F 9/00](#).

References relevant to classification in this group

This subgroup does not cover:

Dynamic binary instrumentation may use techniques similar to emulators and binary optimizers	G06F 11/3644
In-circuit emulation	G06F 11/36
Virtual memory	G06F 12/00
Terminal emulation	G06F 13/105
Computer simulation, in which a model of a system under investigation is being simulated	G06F 17/50

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Emulation	In computing, emulation refers to the duplication and imitation of the functions of one computer system/program by another computer system/program, different from the first one, so that the emulated behaviour fully or closely resembles the behaviour of the original system/program.
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G06F 9/45504

{Abstract machines for programme code execution, e.g Java virtual machine [JVM], interpreters, emulators}

Definition statement

This subgroup covers:

Software implementation of a machine (computer) that executes programs like a physical machine:

- Java Virtual Machine (JVM);
- Microsoft .NET common language runtime (CLR);
- Smalltalk virtual machines.

References relevant to classification in this group

This subgroup does not cover:

Compile time binary to binary translation	G06F 8/52
Run-time interpretation of high level language programs	G06F9/4551
Run-time binary to binary translation	G06F 9/45516

G06F 9/45508

{Runtime interpretation or emulation, e g. emulator loops, bytecode interpretation}

Definition statement

This subgroup covers:

Interpretation of high-level language code, e.g. BASIC.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Handling plain, natural text, word processors, spreadsheets, XML, etc	G06F 17/28
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G06F 9/45512

{Command shells}

Definition statement

This subgroup covers:

Giving commands to a computer (OS) by means of a (graphical) user interface.

These commands can be given via the command line or by performing actions on GUI objects. The commands are typically interpreted by a command interpreter.

- Scripts, recording and executing GUI command scripts.

G06F 9/45516

{Runtime code conversion or optimisation}

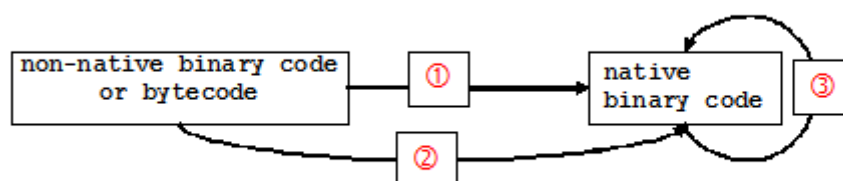
Definition statement

This subgroup covers:

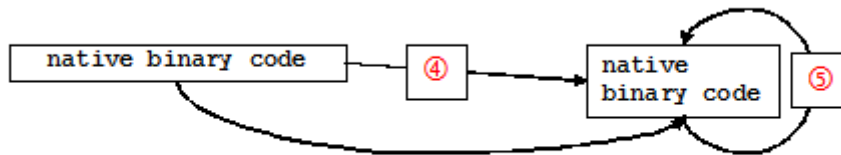
The execution of binary code/bytecode that is not native to the current run-time execution environment by translating the non-native binary code/bytecode into native code just before execution and subsequently executing the native code .

Subsequently, execution can be optimised as follows:

- By performing a retranslation of the non-native binary code/bytecode yielding more optimal native binary code e.g. by taking into account run-time information;
- By directly transforming the native binary code yielding more optimal native binary code .



The [G06F 9/45516](#) also deals with the initial and subsequent run-time transformation of native binary code into more optimal native binary code.



For the purpose of completeness, the [G06F 9/45516](#) also deals with the translation of intermediate bytecode to a different intermediate bytecode (e.g. Java bytecode to UCSD P-code). This however, is a more theoretic possibility and will not occur frequently.

The majority of the documents in this class deal with the translation of intermediate bytecode to native binary code and more specifically with the dynamic compilation of Java bytecodes into native code (JIT compilation).

Relationship between large subject matter areas

- The [G06F 9/45516](#) is the dynamic counterpart of the [G06F 8/52](#)

Both classes have the same goal (i.e. translation from one binary format into another) but the point in time when this translation is performed is different: at run-time, just before or during execution ([G06F 9/45516](#)) and statically, pre-run-time ([G06F 8/52](#)).

- Because the translation in the [G06F 9/45516](#) takes place just before execution, there is less time available
- Difference between [G06F 9/45516](#) and [G06F 9/3017](#)

Both [G06F 9/45516](#) and [G06F 9/3017](#) deal with run-time translation of binary code. However, in the **G06F8/455B4** the translation relates to a program as a whole and is realised by a software translator, whereas in the [G06F 9/3017](#) the translation relates to individual instructions that are about to be executed and is performed by the processor's internal hardware and.

In [G06F 9/45516](#), the processor is fed with the translated, native instructions; it doesn't know anything about the translation that took place. However, in [G06F 9/3017](#) the processor is fed with the non-native instructions; translation into native code takes place on-the-fly (i.e. at the moment the instruction is actually executed by the internal hardware of the processor).

- Difference between [G06F 9/45516](#) and [G06F 9/45508](#)
- The [G06F 9/45508](#) is also related to the execution of binary, non-native code. However, the non-native code is emulated rather than translated:

an emulator acts as an virtual machine and interprets the non-native code.

References relevant to classification in this group

This subgroup does not cover:

Profiling per se	G06F 11/34
Run-time instruction translation	G06F 9/3017

Special rules of classification within this group

Compilation techniques that occur at runtime but that are independent of the runtime aspect, i.e. that might equally well be used in an offline context, should be classified in **G06F9/45** and get Indexing Code [G06F 9/45516](#) .

G06F 9/4552

{Involving translation to a different instruction set architecture, e.g. just-in-time translation in a JVM}

Definition statement

This subgroup covers:

Translation of code at runtime prior to executing it natively, e.g. bytecode into native machine code. Dynamic compilation.

References relevant to classification in this group

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Translation of one binary program to another before the program is ever executed. Static binary translation.	G06F 8/52
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G06F 9/45533

{Hypervisors; Virtual machine monitors}

Definition statement

This subgroup covers:

- Simultaneously executing multiple operating systems using a Virtual Machine Monitor (VMM). The following passage, taken from US2004230794, provides a good definition of a VMM: 'A VMM enables plural operating systems to run on a single machine by "virtualizing" the entire machine. Conventionally, an operating system controls

the use of the physical hardware resources of a machine (e.g., the memory, the processor, etc.), and thus the actual hardware of the machine is exposed to the operating system. When a VMM is used, however, the machine's hardware (e.g., devices) are only exposed to the VMM. The VMM, then, exposes "virtual" machine components to the operating systems'. In [G06F 9/45545](#), plural operating systems execute simultaneously as guest and host (without a VMM)..

- Process switching for virtual machines;
- Handling of non-implemented instructions;
- Address trapping for emulating other memory architectures;
- Host/guest and mode switching instructions;
- Switching between endian modes (endian conversion on a bus [G06F 13/40](#)).

References relevant to classification in this group

This subgroup does not cover:

Mode switching during interrupts per se	G06F 9/4812
Loading of microprogram	G06F 9/24

G06F 9/45537

{Provision of facilities of other operating environments, e.g. WINE (I/O emulation [G06F 13/105](#))}

Definition statement

This subgroup covers:

Emulation of one OS by another OS

- Simultaneously executing first and second operating systems by executing the second OS as a guest OS on top of the first OS (the host OS). No virtual machine monitor (VMM) is needed. The use of guest and host OSs is described in the following passage, taken from US2004230794: ' Certain techniques allow operating systems to exist side-by-side on the same machine without the use of a virtual machine monitor. One such technique is to have one operating system act as a "host" for the other operating system. (The operating system that the "host" is hosting is sometimes called a "guest.") In this case, the host operating system provides the guest with resources such as memory and processor time '
- Interrupt handling of other OS
- Non I/O services of other OS, e.g. facilities for emulation of virtual memory
- Memory mapping and address trapping for emulating I/O

Relationship between large subject matter areas

Associated address trapping is in [G06F 9/45533](#).

References relevant to classification in this group

This subgroup does not cover:

I/O emulation	G06F 13/105
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G06F 9/45541

{Bare-metal, i.e. hypervisor runs directly on hardware}

Definition statement

This subgroup covers:

A bare-metal hypervisor runs directly on the host's hardware to control the hardware and to manage guest operating systems, e.g. Citrix XenServer, VMware ESX, Microsoft Hyper-V..

G06F 9/45545

{Guest-host, i.e. hypervisor is an application program itself, e.g. VirtualBox}

Definition statement

This subgroup covers:

Hypervisor runs within a conventional operating system environment.

G06F 9/4555

{Para-virtualisation, i.e. guest operating system has to be modified}

Definition statement

This subgroup covers:

Para-virtualisation is a virtualization technique that presents a software interface to virtual machines that is similar but not identical to that of the underlying hardware.

G06F 9/45554

{Instruction set architectures of guest OS and hypervisor or native processor differ, e.g. Bochs or VirtualPC on PowerPC MacOS}

Definition statement

This subgroup covers:

Mechanisms to adapt the instruction set of a guest system to the instruction set offered by the underlying hypervisor and/or native processor.

G06F 9/45558

{Hypervisor-specific management and integration aspects}

Definition statement

This subgroup covers:

Relates to specific management and integration aspects of hypervisors.

Functions needed to manage virtual machines or to integrate them into the execution environment that are specific to a hypervised system, e.g. handling of virtual machine instances, creating, cloning, deleting instances, starting and stopping virtual machines, distributing and migrating instances, managing I/O and storage access, isolating virtual machines for security reasons, managing memory of instances.

G06F 9/46

Multiprogramming arrangements

Definition statement

This subgroup covers:

aspects of multiprogramming, i.e. where more than one process / task is present and this presence is essential for identifying the problem and / or the solution; a process / task is defined here as a program in execution.

References relevant to classification in this subclass/group

This subgroup does not cover:

Execution of whatever software without any technically relevant multiprogramming aspect; by technically relevant it is meant that there have to be details on the way in which these multiple tasks co-exist and/or interact (the mere presence of two applications is not sufficient for classifying the document in G06F 9/46)	G06F9/40 , G06F 9/44
Network- and protocol-specific aspects	H04L 29/06

Aspects already covered by G06F 9/48 , G06F 9/50 , G06F 9/52 , G06F 9/54	See special rules of classification of the corresponding classes
Mere development of interfaces / objects	G06F 9/44
Documents just mentioning a multiprocessing / distributed object-oriented systems and which focus on a specific use / application (e.g. e-commerce, monitoring, information retrieval, security)	G06Q 30/00 , G06F 11/00 , G06F 17/30 , G06F 21/00
Access rights associated to human beings or documents where the final aim is to enforce protection at the user level without giving technically relevant details on the multiprogramming implementation	G06F 21/30
Access rights for memory resources, e.g. access to memory according to privilege rings	G06F 12/14
Documents mentioning a transaction but dealing, in fact, with nothing more than techniques involving a request for a service, without any detail on the ACID (Atomicity, Consistency, Isolation, Durability) properties; e.g. e-commerce transactions	G06Q 30/00
Saving and restoring program state during debugging	G06F 11/3636
Saving and restoring the state of a system, i.e. hibernation	G06F 9/4418
Saving and restoring the state of an object, i.e. object persistence	G06F9/44M4
Batch processing	G06F 9/4843
Multi-threading at the hardware level	G06F 9/3851
Suspend and resume task / process / thread execution without details on context saving and restoring	G06F 9/485
Saving and restoring the state of a mobile agent together with additional details on the mobile agent itself	G06F 9/4862

Special rules of classification within this subclass/group

Rule 1

When a document qualifies for one of the classes in the table of rule 2 below, the class [G06F 9/46](#) should not be assigned.

Rule 2

The following table specifies the class to be assigned:

Technical details on:	Class to be assigned:
Saving or restoring of program or task context	G06F 9/461
Saving or restoring of program or task context with multiple register sets This class takes precedence over G06F 9/461	G06F 9/462
Program control block organisation This class takes precedence over G06F 9/461	G06F 9/463
Structure and arrangements for distributed object oriented systems, e.g. CORBA, Jini, DCOM	G06F 9/465
Transaction processing, namely transactions involving the ACID (Atomicity, Consistency, Isolation, Durability) properties	G06F 9/466
Transactional memory, i.e. transparent support for the definition of regions of code that are considered a transaction, the support being provided either in hardware, software or with hybrid-solutions This class takes precedence over G06F 9/466 For speculative lock acquisition, G06F 9/528 takes precedence	G06F 9/467
Specific access rights for resources, e.g. using capability register	G06F 9/468

Rule 3

The following table specifies the classes which could be assigned in addition to the classes of rule 2 above, to cover further technical details; the class(es) identified as Context information should also be checked and assigned, if relevant:

Further technical details on:

The structure of bridges between different distributed object-oriented systems

- Class to be assigned: **S06F209/4601**
- Context information: [G06F 9/465](#)

The lookup of interfaces and/or the structure of lookup servers / repositories

- Class to be assigned: **S06F209/4602**
- Context information: [G06F 9/465](#)

The handling of references to remote objects / namespace implementation details within the context of distributed object-oriented systems

- Class to be assigned: **S06F209/4603**

- Context information: [G06F 9/465](#)

G06F 9/48

Programme initiating; Programme switching, e.g. by interrupt

Definition statement

This subgroup covers:

transfer, initiation or dispatching of tasks, i.e. programs in execution, either locally or within a distributed system

References relevant to classification in this subclass/group

This subgroup does not cover:

Low level (bus-related) details of interrupt handling and interrupt controllers	G06F 13/24
Instruction streams within a processor (e.g. hardware threads) and instruction level details	G06F 9/3836
Mere loading of code linked to the initiation	G06F 9/445
Mere starting of a backup application at a certain date/time	G06F11/14A4B
Mere starting of an antivirus application at a certain date/time	G06F 21/56
Details on the task context structure as well as on its saving and restoring	G06F 9/461
Process migration in the context of load (re-)balancing, without any technically relevant detail on the migration itself	G06F 9/5088
Suspension and resumption at system level (i.e. involving the bootstrapping)	G06F 9/4418
Scheduling of human resources	G06Q 10/00
Scheduling of printer jobs	G06F 3/1296
Compile-time scheduling	G06F9/45E5, G06F9/45M1
Specific details on power distribution and power saving	G06F 1/3203
Scheduling in terms of space	See special rules of classification for G06F 9/50

Special rules of classification within this subclass/group

Rule 1

When a document qualifies for one of the classes in the table of rule 2 below, the class [G06F 9/48](#) should not be assigned.

Rule 2

The following table specifies the class to be assigned:

Technical details on:	Class to be assigned:
Initiation of a task by means of an interrupt, i.e. the aspects of handling/servicing an interrupt	G06F 9/4812
Interrupt priority mechanisms This class takes precedence over G06F 9/4812	G06F 9/4818
Initiation of a task by means of a timer related interrupt This class takes precedence over G06F 9/4812	G06F 9/4825
Initiation of a task by means of an interrupt with variable priority This class takes precedence over G06F 9/4812	G06F 9/4831
Initiation of a task by means of an interrupt with variable priority, said priority being time dependent This class takes precedence over G06F 9/4812 and G06F 9/4831	G06F 9/4837
Initiation, transfer and dispatch of a task, i.e. a program in execution, by another program; creation, e.g. fork() system call, and initiation, e.g. exec() system call, of a task / process / thread, virtual machine in the same or different machine	G06F 9/4843
Task life-cycle, e.g. stopping, restarting, resuming execution This class takes precedence over G06F 9/4843 For scheduling algorithms and internal operation of a scheduler, G06F 9/4881 takes precedence	G06F 9/485
Resuming the execution of a task on a different machine, i.e. migration This class takes precedence over G06F 9/4843 This class takes precedence over G06F 9/485 For migration for load balancing purposes, G06F 9/5088 takes precedence	G06F 9/4856

Mobile agents, i.e. tasks specifically designed to migrate This class takes precedence over G06F 9/4843 This class takes precedence over G06F 9/485 This class takes precedence over G06F 9/4856 For cloning and replication of mobile agents, only G06F 9/4868 should be assigned For migration policy, e.g. auction, contract negotiation, of mobile agents, only G06F 9/4875 should be assigned	G06F 9/4862
Scheduling strategies for dispatcher, e.g. round robin, multilevel priority queues; internal operation of a scheduler	G06F 9/4881
Algorithms for real-time scheduling of processes, i.e. scheduling taking into account the deadlines of the applications being executed This class takes precedence over G06F 9/4843 This class takes precedence over G06F 9/4881	G06F 9/4887
Power and heat aware scheduling of tasks This class takes precedence over G06F 9/4843 This class takes precedence over G06F 9/4881	G06F 9/4893

Rule 3

The following table specifies the classes which could be assigned in addition to the classes of rule 2 above, to cover further technical details; the class(es) identified as context information should also be checked and assigned, if relevant:

Further technical details on:

Exception handling

- Class to be assigned: **S06F209/4801**
- Context information: [G06F 9/4812](#)

Application starting, stopping, resuming

- Class to be assigned: **S06F209/4802**
- Context information: [G06F 9/485](#)

Scheduling of tasks on multiprocessor systems

- Class to be assigned: **S06F209/4803**
- Context information: [G06F 9/4881](#), [G06F 9/4887](#), [G06F 9/4893](#)

Scheduling of a set of tasks by taking into account precedence and dependency constraints, or time and/or occurrence of events

- Class to be assigned: **S06F209/4804**
- Context information: [G06F 9/4881](#), [G06F 9/4887](#), [G06F 9/4893](#)

Scheduling of a set of tasks by taking into account constraints on resources, resource based scheduling of tasks

- Class to be assigned: **S06F209/4805**
- Context information: [G06F 9/4881](#), [G06F 9/4887](#), [G06F 9/4893](#)

Internals of a task scheduler

- Class to be assigned: **S06F209/4806**
- Context information: [G06F 9/4881](#), [G06F 9/4887](#), [G06F 9/4893](#)

Synonyms and Keywords

The expression "scheduling", in the patent- and non patent-documentation, can have two distinct meanings when referring to task and resources:

- 1) scheduling in terms of time, with the acceptance of task scheduling, i.e. when to assign a task to a computing unit,
- 2) scheduling in terms of space, with the acceptance of resource scheduling, i.e. which resource(s) to allocate and how to partition them.

It is the first interpretation, the one which can be found in the context of the [G06F 9/48](#).

G06F 9/50

Allocation of resources, e.g. of the central processing unit [CPU]

Definition statement

This subgroup covers:

selection, allocation and de-allocation of hardware and/or software resources, like servers, processes, threads, CPUs, memory; combination and/or partitioning of resources, e.g. cloud computing, hypervisors and logical partitions; mapping of tasks onto parallel / distributed machines; load balancing and re-balancing of resources in distributed systems.

References relevant to classification in this subclass/group

This subgroup does not cover:

Allocation based on bandwidth, protocol and network related aspects	H04L 29/06
Allocation of human resources	G06Q 10/00
Allocation of resources within a printer / multifunctional peripheral	H04N 1/00

Scheduling of printer jobs	G06F 3/1296
Allocation of disk resources and storage resources in general not being RAM	G06F 3/0604
Garbage collection techniques	G06F 12/023
Pure scheduling aspects, i.e. scheduling in terms of time, without considering resource allocation	G06F 9/4881 , G06F 9/4887 , G06F 9/4893
Mapping of tasks onto multi-processor systems carried out at compile-time	G06F9/45M1
Specific details on emulation and internal functioning of a virtual machine	G06F 9/455
Specific details on power distribution and power saving	G06F 1/3203

Special rules of classification within this subclass/group

Rule 1

When a document qualifies for one of the classes in the table of rule 2 below, the class [G06F 9/50](#) should not be assigned.

Rule 2

The following table specifies the class to be assigned:

Technical details on:	Class to be assigned:
Allocation of resources to service a request	G06F 9/5005
Allocation of resources to service a request, the resources being hardware resources other than CPUs, Servers and Terminals This class takes precedence over G06F 9/5005	G06F 9/5011
Allocation of memory resources to service a request This class takes precedence over G06F 9/5005 This class takes precedence over G06F 9/5011 for documents detailing both the allocation and release of memory resources, the class G06F 9/5022 should also be assigned	G06F 9/5016
Release of resources This class takes precedence over G06F 9/5005 This class takes precedence over G06F 9/5011 For documents detailing both the allocation and release of memory resources, the class G06F 9/5016 should also be assigned	G06F 9/5022

Allocation of processing resources, e.g. CPUs, Servers, Terminals, processes, threads, virtual machines	G06F 9/5027
A llocation of processing resources by considering data affinity This class takes precedence over G06F 9/5005 This class takes precedence over G06F 9/5027	G06F 9/5033
A llocation of processing resources by considering the execution order of a plurality of tasks, e.g. taking priority or time dependency constraints into consideration. Candidates for this group are documents dealing with requests for composite (web) services, where the various components should execute in a certain order and resources for said execution should be assigned accordingly. Also included are documents dealing with “workflow” like systems, where a request to “execute” a project definition, comprising a set of interrelated actions, is sent to a server This class takes precedence over G06F 9/5005 This class takes precedence over G06F 9/5027	G06F 9/5038
A llocation of processing resources by considering hardware capabilities This class takes precedence over G06F 9/5005 this class takes precedence over G06F 9/5027	G06F 9/5044
Allocation of processing resources by considering the load This class takes precedence over G06F 9/5005 This class takes precedence over G06F 9/5027	G06F 9/505
Allocation of processing resources by considering software capabilities, namely software resources associated or available to the machine, e.g. Web services offered by a specific machine This class takes precedence over G06F 9/5005 This class takes precedence over G06F 9/5027	G06F 9/5055
Partitioning or combining of resources This class should contain also documents dealing with cluster membership, i.e. assignment of a server to a certain group based on some criteria (see exemplary documents WO0156785, EP0805393).	G06F 9/5061
Algorithms for mapping a plurality of inter-dependent sub-tasks onto a plurality of physical CPUs This class takes precedence over G06F 9/5061	G06F 9/5066

Grid computing, cloud computing With the expression grid / cloud computing it is meant an environment where multiple services are offered by the various members of the grid (often making use of idle periods), said members being usually located over a large scale network. Candidate documents should have at least one of the following concepts: i) set up of a grid, e.g. registering a new member, re-organizing the grid; ii) usage of a service in the grid, e.g. locating the member, servicing a request. This class takes precedence over G06F 9/5061	G06F 9/5072
Logical partitioning of resources; management and configuration of virtualized resources This group deals with the creation and management (e.g. allocation) of logical partitions and resulting virtual machines in multiprocessor systems; it also deals with the concept of virtualization in general, namely the mere management (e.g. creation, deletion) of an abstract, logical representation of a resource and its configuration (e.g. re-definition of its behaviour). This class takes precedence over G06F 9/5061 For documents detailing the migration of a virtual machine to a different node, the class G06F 9/4856 should also be assigned	G06F 9/5077
Techniques for balancing or rebalancing the load in a distributed system by taking into account the load of the whole system	G06F 9/5083
Techniques for balancing or rebalancing the load in a distributed system by migrating tasks / jobs / virtual machines This class takes precedence over G06F 9/5083 For documents detailing the migration of a task/job/virtual machine to a different node, the class G06F 9/4856 should also be assigned	G06F 9/5088
Allocation of resources based on power and heat considerations	G06F 9/5094

Rule 3

The following table specifies the classes which could be assigned in addition to the classes of rule 2 above, to cover further technical details; the class(es) identified as Context information should also be checked and assigned, if relevant:

Further details on:

Allocation based on performance criteria

- Class to be assigned: **S06F209/5001**
- Context information: [G06F 9/5027](#), [G06F 9/5033](#), [G06F 9/5038](#), [G06F 9/5044](#), [G06F 9/505](#), [G06F 9/5055](#)

Allocation based on proximity

- Class to be assigned: **S06F209/5002**
- Context information: [G06F 9/5027](#), [G06F 9/5033](#), [G06F 9/5038](#), [G06F 9/5044](#), [G06F 9/505](#), [G06F 9/5055](#)

Indication of availability of resources

- Class to be assigned: **S06F209/5003**
- Context information: All groups belonging to [G06F 9/50](#)

Enforcing and/or taking into account lower and/or upper ceilings on resource usage in the context of resource allocation

- Class to be assigned: **S06F209/5004**
- Context information: All groups belonging to [G06F 9/50](#)

Cluster membership

- Class to be assigned: **S06F209/5005**
- Context information: [G06F 9/5061](#)

Dependency or time-specific aspects which are taken into account during the allocation

- Class to be assigned: **S06F209/5006**
- Context information: [G06F 9/5038](#)

Allocation of low-level processor resources, e.g. logical units, registers, cache lines, decoding stages

- Class to be assigned: **S06F209/5007**
- Context information: [G06F 9/5011](#), [G06F 9/5016](#), [G06F 9/5022](#)

Monitoring techniques used in conjunction with the CPU / thread allocation

- Class to be assigned: **S06F209/5008**
- Context information: All groups belonging to [G06F 9/50](#)

Offloading computations (e.g. because lacking some of the necessary capabilities)

- Class to be assigned: **S06F209/5009**
- Context information: [G06F 9/5027](#), [G06F 9/5033](#), [G06F 9/5038](#), [G06F 9/5044](#), [G06F 9/505](#), [G06F 9/5055](#)

Allocation based on priority

- Class to be assigned: [G06F 2209/5011](#)

- Context information: [G06F 9/5027](#), [G06F 9/5033](#), [G06F 9/5038](#), [G06F 9/5044](#), [G06F 9/505](#), [G06F 9/5055](#)

Creation, use, management of pool of resources

- Class to be assigned: **S06F209/5010**
- Context information: All groups belonging to [G06F 9/50](#)

Controlling aspects of an already submitted request, e.g. polling for a status, deleting / modifying the request

- Class to be assigned: [G06F 2209/5013](#)
- Context information: [G06F 9/5027](#), [G06F 9/5033](#), [G06F 9/5038](#), [G06F 9/5044](#), [G06F 9/505](#), [G06F 9/5055](#)

Reservation of resources so as to have them ready at the time of the actual allocation

- Class to be assigned: [G06F 2209/5014](#)
- Context information: All groups belonging to [G06F 9/50](#)

Selection, by a broker, based on the submitted request, of an appropriate server via a registry or a yellow pages server

- Class to be assigned: [G06F 2209/5015](#)
- Context information: [G06F 9/5027](#), [G06F 9/5033](#), [G06F 9/5038](#), [G06F 9/5044](#), [G06F 9/505](#), [G06F 9/5055](#)

Session management

- Class to be assigned: [G06F 2209/5016](#)
- Context information: [G06F 9/5027](#), [G06F 9/5033](#), [G06F 9/5038](#), [G06F 9/5044](#), [G06F 9/505](#), [G06F 9/5055](#)

Task decomposition

- Class to be assigned: [G06F 2209/5017](#)
- Context information: **G06F9/50A6**, [G06F 9/5033](#), [G06F 9/5038](#), [G06F 9/5044](#), [G06F 9/505](#), [G06F 9/5055](#)

Selection of a thread / process within a multithreaded / multiprocessing machine, said selection being aimed to service a request

- Class to be assigned: [G06F 2209/5018](#)
- Context information: [G06F 9/5027](#), [G06F 9/5033](#), [G06F 9/5038](#), [G06F 9/5044](#), [G06F 9/505](#), [G06F 9/5055](#)

Workload prediction within the context of CPU / process allocation and load rebalancing

- Class to be assigned: [G06F 2209/5019](#)
- Context information: [G06F 9/5083](#), [G06F 9/5088](#)

Workload threshold within the context of CPU / process allocation and load rebalancing

- Class to be assigned: [G06F 2209/5019](#)
- Context information: [G06F 9/5083](#), [G06F 9/5088](#)

remote execution techniques whereby program code is executed remotely from the client that initiated the execution and the client provides the code to the remote machine

- Class to be assigned: **S06F209/5409**
- Context information: All groups belonging to [G06F 9/50](#)

Synonyms and Keywords

The expression "scheduling", in the patent- and non patent-documentation, can have two distinct meanings when referring to task and resources:

- 1) scheduling in terms of time, with the acceptance of task scheduling, i.e. when to assign a task to a computing unit,
- 2) scheduling in terms of space, with the acceptance of resource scheduling, i.e. which resource(s) to allocate and how to partition them.

It is the second interpretation, the one which can be found in the context of [G06F 9/50](#).

G06F 9/52

Programme synchronisation; Mutual exclusion, e.g. by means of semaphores; {Contention for resources among tasks}

Definition statement

This subgroup covers:

Arbitrating access from tasks to shared resources (e.g. mutual exclusion), synchronising the execution of tasks with respect to each others (e.g. producer - consumer) ; a task is defined here as a program in execution.

References relevant to classification in this subclass/group

This subgroup does not cover:

Arbitration of access on a bus	G06F 13/14
Concurrency management in a database	G06F 17/30008
Transaction processing	G06F 9/466
Generation of synchronisation instructions at compile time	G06F9/45

Speculative instruction issuing and/or data consistency	G06F 9/3842 , G06F 9/3834
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Special rules of classification within this subclass/group

Rule 1

When a document qualifies for one of the classes in the table of rule 2 below, the class [G06F 9/52](#) should not be assigned

Rule 2

The following table specifies the class to be assigned:

Technical details on:	Class to be assigned:
Barrier synchronisation	G06F 9/522
Algorithms to detect and / or avoid deadlocks when tasks interact with each other	G06F 9/524
Mutual exclusion algorithms, specific implementations of locks and other means to ensure a "correct" (from the concurrency point of view) access to a shared resource	G06F 9/526
Speculative execution beyond synchronisation primitives (e.g. busy lock) This class takes precedence over G06F 9/526 ; e.g. if a document discloses a mutual exclusion algorithm involving speculative execution beyond busy locks, then it should be classified only in the G06F 9/528 and not also in the G06F 9/526	G06F 9/528

Rule 3

The following table specifies the classes which could be assigned in addition to the classes of rule 2 above, to cover further technical details:

Further technical details on:

Low level features of atomic instructions (e.g. test&set) used to implement locks / mutual exclusion primitives

- Class to be assigned: **S06F209/5202**
- Context information: [G06F 9/526](#), [G06F 9/528](#)

Tokens (e.g. cooperative locking), token managers and lock managers

- Class to be assigned: **S06F209/5203**
- Context information: [G06F 9/526](#), [G06F 9/528](#)

Multi-mode locks, i.e. with locks specifying also a mode (e.g. read-write)

- Class to be assigned: **S06F209/5203**
- Context information: [G06F 9/526](#), [G06F 9/528](#)

G06F 9/54

Interprogramme communication; {Intertask communication}

Definition statement

This subgroup covers:

Communication between tasks, i.e. programs, processes, threads in execution, either on the same machine or on different ones, where the multiprogramming aspect is relevant, e.g. Inter-Process-Communication.

References relevant to classification in this subclass/group

This subgroup does not cover:

Communication between a device and a CPU without any technically relevant detail on multiprogramming concepts or with device specific details	G06F 3/00 , G06F 13/00 , G06F 13/102 (for device drivers)
Hardware mechanisms for inter-CPU communication	G06F 15/163
Network- and protocol-specific details	H04L 29/06
Event management relating to network management, e.g. alarms produced by network devices, and no technically relevant details on the multiprocessing aspect is present	H04L 12/2419
Collaborative editing on a file without any technically relevant details on the event handling aspect	G06F 17/22 , G06Q 10/10
Interaction of the user with the system, i.e. the GUI, and not between the Processes / applications subsequent to the user interaction	G06F 3/048
Addressing memory	G06F 12/02
Messages being distributed over a network, i.e. e-mails, instant messaging	H04L 12/58 , G06Q 10/107
Communication which does not involve multiprogramming concepts, e.g. invocation of a subroutine	G06F9/40 , G06F 9/44
Pattern-adapters	G06F 9/44
Non-remote method invocation between objects	G06F 9/443

Communication between tasks but predominant aspect peculiar of another field, e.g. monitoring, information retrieval on the web, software download and installation	G06F 11/30 , G06F 17/30 , G06F 8/65
Architectural details, e.g. interface repositories, object adapters, on distributed object-oriented systems, e.g. CORBA, DCOM Communication-specific details of the remote method invocation should (also) be classified in G06F 9/548	G06F 9/465
Allocation of a remote service to a client	G06F 9/50

Rule 1

When a document qualifies for one of the classes in the table of rule 2 below, the class [G06F 9/54](#) should not be assigned.

Rule 2

The following table specifies the class to be assigned:

Technical details on:	Class to be assigned:
Adapter mechanisms e.g. between incompatible applications	G06F 9/541
Communication between tasks, either on the same machine or on different ones, by subscribing to events and issuing event notifications when certain events happen, e.g. Event Management Systems, Unix alarms; communication aspects related to the broadcasting of the notifications	G06F 9/542
User-generated data transfer from the process / application point of view, e.g. clipboards, dynamic data exchange (DDE), object linking and embedding (OLE)	G06F 9/543
Communication of processes via buffers, shared memory, pipes, sockets and the like	G06F 9/544
Communication between tasks residing in different layers e.g. user- and kernel-space	G06F 9/545
Communication of processes via a message passing system, i.e. messaging middleware, and the inherent technicalities, e.g. message structure or queue handling; delivery of messages according to preferences of the recipients (which have to be processes)	G06F 9/546

Implementation of Remote Procedure Calls, e.g. stubs, (un-)marshalling of parameters, namely invocation of a procedure at a remote location; lightweight RPC, i.e. procedure call between protection domains / different address spaces on a single machine	G06F 9/547
Implementation of Remote Method Invocations, i.e. details which are peculiar to RPC between (mainly Java and COM) objects, e.g. object serialization, stub / proxy download This class takes precedence over G06F 9/547	G06F 9/548

Rule 3

The following table specifies the classes which could be assigned in addition to the classes of rule 2 above, to cover further technical details:

Further technical details on:

Communication aspects related to task execution in a client-server system

- Class to be assigned: **S06F209/5401**
- Context information: All groups belonging to [G06F 9/54](#)

Interception of communications between tasks / layers

- Class to be assigned: **S06F209/5402**
- Context information: All groups belonging to [G06F 9/54](#)

Handling of events within a single system, e.g. Unix alarms

- Class to be assigned: **S06F209/5403**
- Context information: [G06F 9/542](#)

Distributed event management systems or handling of events produced in a distributed system

- Class to be assigned: **S06F209/5404**
- Context information: [G06F 9/542](#)

Event handling related to the execution of a GUI and as long as the event handling aspect is technically relevant

- Class to be assigned: **S06F209/5405**
- Context information: [G06F 9/542](#)

Broadcasting / multicasting and sequence related problems of event related messages and as long as the network aspect, if any, is not predominant

- Class to be assigned: **S06F209/5406**
- Context information: [G06F 9/542](#)

Exchange of messages between processes by using a Message Oriented Middleware, e.g. Java Messaging Services

- Class to be assigned: **S06F209/5407**
- Context information: [G06F 9/546](#)

Particular techniques for handling message queues (or similar structures)

- Class to be assigned: **S06F209/5408**
- Context information: [G06F 9/546](#)

Remote execution techniques whereby program code is executed remotely from the client that initiated the execution and the client provides the code to the remote machine

- Class to be assigned: **S06F209/5409**
- Context information: All groups belonging to [G06F 9/54](#)

G06F 11/00

Error detection; Error correction; Monitoring (methods or arrangements for verifying the correctness of marking on a record carrier [G06K 5/00](#); in information storage based on relative movement between record carrier and transducer [G11B](#), e.g. [G11B 20/18](#); in static stores [G11C](#); coding, decoding or code conversion, for error detection or error correction, in general [H03M 13/00](#))

Definition statement

This group covers:

- Error avoidance ([G06F 11/004](#))
- Identification related to error detection / correction or monitoring ([G06F 11/006](#))
- Reliability and availability analysis of computing systems ([G06F 11/008](#))
- Error detection and/or correction ([G06F 11/07](#) and subgroups)
- Detection or location of defective computer hardware by testing at a time outside of "normal operating mode", e.g. during standby, idle time or at power on ([G06F 11/22](#) and subgroups)
- Checking the correct order of processing ([G06F 11/28](#))
- Monitoring on computing systems ([G06F 11/30](#) and subgroups)
- Preventing errors by analysing, debugging and testing software ([G06F 11/36](#) and subgroups)

References relevant to classification in this group

This group does not cover:

Testing of digital circuits that do not incorporate a programmable processing logic	G01R 31/00
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Error detection, correction or monitoring in control systems	G05B 23/02
Monitoring of power supply means for computer, detecting and responding to power failures in a computer system	G06F 1/28 G06F 1/30
Protection against unauthorized memory accesses	G06F 12/00
Security arrangements for protecting computers or computer systems against unauthorised activity or attacks	G06F 21/00
Exception handling during program execution	G06F 9/3861
Methods or arrangements for verifying the correctness of marking on a record carrier	G06K 5/00
Registering or indicating the working of vehicles	G07C 5/00
Error detection, correction or monitoring in information storage based on relative movement between record carrier and transducer	G11B 20/18 G11B 27/36
Error detection, correction or monitoring in static stores	G11C
Coding, decoding or code conversion, for error detection or error correction, in general	H03M 13/00
Detecting and preventing errors in transmission systems	H04L 1/00
Broadcast and reliability in networks	H04L 12/1863
Fault management in networks, network monitoring, network testing.	H04L 12/2419 H04L 12/2602 H04L 12/2697
Network security. Monitoring network traffic to detect malicious traffic. Protection against malicious traffic	H04L 29/06877
Counter measures to a fault in a network	H04L 29/14
Monitoring and testing of wireless networks	H04W 24/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Digital transmission of data	H04L
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Special rules of classification within this group

Implementation details of particular digital data processing techniques applied to error detection, error correction or monitoring are classified in the relevant subgroups of [G06F 11/00](#).

The error detection/correction process in neural networks is also covered ([G06F 11/1476](#)).

Glossary of terms

In this group, the following terms (or expressions) are used with the meaning indicated:

Fault	Physical defect, imperfection, or flaw that occurs within some hardware component, or logical defect of a piece of software. Essentially, the definition of a fault, as used in the fault tolerance community, agrees with the definition found in the dictionary. Faults may be permanent, transient or intermittent.
Error	The logical manifestation of a fault, observable in terms of incorrect instructions of or corrupted data in a (computer) system. E.g. a fault in a DRAM cell will never be observed if the memory location is never accessed. Specifically, an error is a deviation from accuracy or correctness.
Failure	The incorrect functioning of a system as perceivable by a user or the system's environment as a consequence of an error. A failure is the non-performance, the untimely performance or the performance in a subnormal quantity or quality of some action that is due or expected.
Redundant hardware	Additional hardware for performing the same function as another hardware part, provided that in faultless operation you could renounce on either hardware parts of the system without losing functionality.
Data representation	A physical or logical encoding (scheme) for data, which allows the latter to be processed, stored or transmitted by a machine.
Redundancy in data representation	A representation of data using more resources than strictly necessary to encode the desired information such that in the error free situation one could renounce to some of said resources without losing information.
Redundancy in operation	Performing (a set of) operations more than once, or performing sequentially different implementations of a particular function, or performing additional operations which (allow to) restore a system in a state from which its correct operation can be resumed after a failure.

Time diversity	the concept to have an redundant system in which one of the redundant components operates with a delay with respect to the other in order to avoid common mode failures that would affect both redundant components in the same way at the same time, thereby not being detectable/correctable.
Master-checker setup	A redundant configuration in which a master CPU drives the system. The checker CPU is synchronized (often at clock level) with the master. It processes the input data stream as the master (and often also the very same program). Whenever the master drives an output signal, the checker compares its own value with the data written by the master. A mismatch triggers an error signal. The master-checker mode is supported in many modern microprocessors by a comparator integrated into the pin driver circuitry, thus reducing the external logic to a few chips for interfacing the error signals." The master-checker system generally gives more accurate answers by ensuring that the answer is correct before passing it on to the application requesting the algorithm being completed. It also allows for error handling if the results are inconsistent. Depending on the merit of a correct answer, a checker-CPU may or may not be warranted. In order to alleviate some of the cost in these situations, the checker-CPU may be used to calculate something else in the same algorithm, increasing the speed and processing output of the CPU system." There are two possible configurations: Master-Listener and Cross-Coupled. The Master-Listener lock step configuration pairs two processors, with one as a complete Master and the other as a complete Listener, the latter having disabled output drivers. In the Cross-Coupled configuration, one of the processors, the SI-Master, drives the system interface bus, while the other processor, the SC-Master, drives the secondary cache bus. The SI-Master has disabled output drivers for the secondary cache interface bus while the SC-Master has disabled output drivers for the system interface bus

Normal operating mode	The operation of a system or software once it is deployed and provides the desired service as opposed to its development, maintenance, test or idle time.
Fault masking	Hiding the presence of an fault to the user or the environment of a (computer system by means of some sort of redundancy such that the perceived system functionality is not affected.
Active fault masking	Taking particular actions (e.g. reconfiguration, failover) not performed in the error free situation to mask a fault.
Passive fault masking	When a system operates such that no particular action is necessary to mask a fault because all necessary operations are constantly performed independently of the presence of a fault (e.g. majority voting).
Normal operating mode	the operation of a system or software once it is deployed and provides the desired service as opposed to its development, maintenance, test or idle time.
Interconnections	are physical media and may be of point-to-point type or of bus type. Two interconnections are only considered redundant if: they both physically connect the same nodes, wherein nodes are the source producing or the final destination consuming the data to be transmitted, and are configured to perform the same data transmissions.
Monitoring	monitoring refers to an extra functionality for observing properties of a running computing system in its normal operating condition without inputting test data
Mirrored data	Two copies of the data where it is supposed that both copies contain the same data at any moment.
Backed up data	The second copy of the data reflects the data of the first copy at a particular moment.

G06F 11/002

{protecting against parasitic influences, e.g. noise, temperatures}

Special rules of classification within this group

In this group the use of the Indexing Codes [G06F 2201/00](#) and lower is mandatory.

G06F 11/004

{Error avoidance ([G06F 11/07](#) and subgroups take precedence)}

Definition statement

This subgroup covers:

All measures taken to prevent an error from happening. This can either be by preventing the fault from being present or by ensuring that the presence of the fault will not lead to an error.

References relevant to classification in this group

This subgroup does not cover:

Measures in response to the occurrence of a fault, e.g. measures designed to limit the impact of the error	G06F 11/07
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Special rules of classification within this group

In this group the use of the Indexing Codes [G06F 2201/00](#) and lower is mandatory.

This subgroup is only to be used for subject-matter for which no other technique (like fault-masking based on redundancy) to respond to the occurrence of a fault applies. If techniques corresponding to [G06F 11/07](#) and subgroups apply, the subject-matter must be classified there instead.

G06F 11/006

{Identification ([G06F 11/2289](#) takes precedence)}

Special rules of classification within this group

In this group the use of the Indexing Codes [G06F 2201/00](#) and lower is mandatory.

G06F 11/008

{Reliability or availability analysis}

Definition statement

This subgroup covers:

Reliability theory describes the probability of a system completing its expected function during an interval of time. In reliability theory availability is the degree to which a system is in a specified functioning condition. In the literature various definitions can be found. One well established defines availability as "the probability that a system is operating at a specified time t ", Barlow and Proschan: Mathematical Theory of Reliability (1975). A simple representation of availability is a ratio of the expected value of the uptime of a system to the aggregate of the expected values of up and down time. For example in the case of systems having a MTBF (Mean Time Between Failure) and MTTR (Mean Time to Recovery), $\text{availability} = \text{MTBF} / (\text{MTBF} + \text{MTTR})$. Typical terminology that the group contains: error prediction, failure rate, predictive maintenance, longevity, etc. A lot of documents deal with pure theory and propose new formula for better assessing a system in terms of reliability.

References relevant to classification in this group

This subgroup does not cover:

Forecasting, planning	G06Q 10/00
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Reliability	The term refers to the ability of a system or component to perform its required functions under stated conditions for a specified period of time.
Availability	The ratio of the total time a functional unit is capable of being used during a given interval to the length of the interval.
Downtime	The term downtime is used to refer to periods when a system is unavailable.
Uptime	Part of active time during which an equipment, machine, or system is either fully operational or is ready to perform its intended function.
MTBF	Mean Time Between failure is the predicted elapsed time between inherent failures of a system during operation.

MTTF	Mean Time to Failure is the time taken for a part or system to fail for the first time.
MTTR	Mean Time To Repair is a basic measure of the maintainability of repairable items. It represents the average time required to repair a failed component or device.
MTTR	Mean Time To Recovery is the average time that a device will take to recover from any failure.

G06F 11/07

responding to the occurrence of a fault, e.g. fault tolerance

Definition statement

This subgroup covers:

- Error detection/correction on computing systems using redundancy in data representation (also includes RAID systems involving parity) ([G06F 11/08](#) and subgroups).
- Error detection/correction on computing systems using redundancy in operations ([G06F 11/14](#) and subgroups).
- Error detection/correction on computing systems using redundancy in hardware ([G06F 11/16](#) and subgroups).
- Error or fault processing without redundancy ([G06F 11/0703](#) and subgroups).
- Safety measures ([G06F 11/0796](#))

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Fault	Physical defect, imperfection, or flaw that occurs within some hardware component, or logical defect of a piece of software. Essentially, the definition of a fault, as used in the fault tolerance community, agrees with the definition found in the dictionary. Faults may be permanent, transient or intermittent.
Error	The logical manifestation of a fault, observable in terms of incorrect instructions of or corrupted data in a (computer) system. E.g. a fault in a DRAM cell will never be observed if the memory location is never accessed. Specifically, an error is a deviation from accuracy or correctness.

Failure	The incorrect functioning of a system as perceivable by a user or the system's environment as a consequence of an error. A failure is the non-performance, the untimely performance or the performance in a subnormal quantity or quality of some action that is due or expected.
Redundant hardware	Additional hardware for performing the same function as another hardware part, provided that in faultless operation you could renounce on either hardware parts of the system without losing functionality.
Data representation	A physical or logical encoding (scheme) for data, which allows the latter to be processed, stored or transmitted by a machine.
Redundancy in data representation	A representation of data using more resources than strictly necessary to encode the desired information such that in the error free situation one could renounce to some of said resources without losing information.
Redundancy in operation	Performing (a set of) operations more than once, or performing sequentially different implementations of a particular function, or performing additional operations which (allow to) restore a system in a state from which its correct operation can be resumed after a failure.
Normal operating mode	The operation of a system or software once it is deployed and provides the desired service as opposed to its development, maintenance, test or idle time.
Fault masking	Hiding the presence of an fault to the user or the environment of a (computer system by means of some sort of redundancy such that the perceived system functionality is not affected.
Active fault masking	Taking particular actions (e.g. reconfiguration, failover) not performed in the error free situation to mask a fault.
Passive fault masking	When a system operates such that no particular action is necessary to mask a fault because all necessary operations are constantly performed independently of the presence of a fault (e.g. majority voting).
Mirrored data	Two copies of the data where it is supposed that both copies contain the same data at any moment.

Backed up data	The second copy of the data reflects the data of the first copy at a particular moment.
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G06F 11/0703

{Error or fault processing not based on redundancy, i.e. by taking additional measures to deal with the error or fault not making use of redundancy in operation, in hardware, or in data representation}

Definition statement

This subgroup covers:

The methods for error/fault processing on computing systems in normal operating mode that do not imply the use of any redundancy techniques. The error/fault processing, as it is defined in the subgroup, comprises one or more of the following steps:

- the error detection step ([G06F 11/0751](#) and subgroups)
- the error/fault reporting/storing step ([G06F 11/0766](#) and subgroups)
- the root cause analysis step of the error/fault ([G06F 11/079](#))
- the remedying step ([G06F 11/0793](#))
- wherein
- the error/fault reporting/storing refers to collecting/storing of information related to the error/fault (e.g. a performing a memory dump after detecting an error).
- the root cause analysis of an error aims at identifying the initial cause of an error/fault.
- the remedying step refers to the actions taken on the computing system in order to overcome an error/fault.
- It should be noted that the subgroup does not cover the error/fault detection methods involving the check of the correct order of processing of a program or a system ([G06F 11/28](#)).

Relationship between large subject matter areas

Root cause analysis in a hardware testing environment: [G06F 11/22](#)

Root cause analysis in a software testing/debugging environment:
[G06F 11/36](#)

References relevant to classification in this group

This subgroup does not cover:

Error/fault processing in manufacturing/control systems/environment	G05B 23/02
Monitoring power failures	G06F 1/28

Responding to power failures	G06F 1/30
Error/fault detection or recovery by retry	G06F 11/14
Error/fault detection by checking the correct order of processing of a system or a program	G06F 11/28
Monitoring per se, reporting or storing of non-error data	G06F 11/30 G06F 11/34
Protection against unauthorized memory accesses	G06F 12/00
Security (detection of attacks, malware, unauthorised accesses)	G06F 21/00
Exception handling during concurrent execution	G06F 9/3861
Error detection, correction or monitoring in information storage based on relative movement between record carrier and transducer	G11B 20/18 G11B 27/36
Error in Transmission Systems (error detection/correction in data transmission)	H04L 1/00
Fault management in networks wherein the error/fault is related to the data exchange protocols or to the network equipments (e.g. routers or a switches)	H04L 12/2419
Monitoring of traffic in a network or of network components (e.g. routers or switches)	H04L 12/2602
Network security Detection/protection against malicious traffic	H04L 29/06877
Monitoring testing in wireless networks	H04W 24/00

Special rules of classification within this group

Classifying a document within [G06F 11/0703](#) - [G06F 11/0793](#) requires the two following actions:

- Classifying the document in a subgroup corresponding to the most relevant functional aspect of the error/fault processing described in the document.
- [G06F 11/0751](#) and its subgroups for the function of error/fault detection e.g. comparing data to an error threshold
- [G06F 11/0766](#) and its subgroups for the function of error/fault reporting/storing
- e.g. performing a memory dump after detecting an error
- [G06F 11/079](#) for the function of root cause analysis
- e.g. determining the first error event causing the others
- [G06F 11/0793](#) for the function of error/fault remedying
- e.g. executing a specific interrupt handler to clear the error/fault

- Although it is not standard practice, a document can be classified in several subgroups of the list defined above, according to the circumstances.
- Classifying the document in a subgroup corresponding to the most relevant architectural environment described in the document, see subgroups from [G06F 11/0709](#) to [G06F 11/0748](#).

No such assignment is required in case the document provides no architectural details or refers to a general computer.

Similarly, a document can be classified in several "architecture" subgroups, according to the circumstances.

G06F 11/0796

{Safety measures, i.e. ensuring safe condition in the event of error, e.g. for controlling element}

Definition statement

This subgroup covers:

A safe computer system protects its user(s) and/or environment from hazards whether its intended function is performed correctly or not. This group deals with measures taken to ensure that a computer-based system stays safe (i.e. does not present a danger to persons or its environment) when it is no longer able to provide its normal functionality due to the presence of an error. This requirement typically occurs in many real-time control systems. The subject-matter of this group is different from fault-masking since the latter attempts to maintain the desired functionality of a system in the presence of faults whereas this group relates to ensuring a safe condition when faults cannot be masked, thereby degrading the desired system functionality.

Informative references

Attention is drawn to the following places, which may be of interest for search:

If such a system continues to operate albeit with degraded hardware or software functionality, additional classification symbols in the appropriate subgroups may be necessary.	G06F 11/142
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Special rules of classification within this group

In this group the use of the Indexing Codes [G06F 2201/00](#) and lower is mandatory.

G06F 11/08

Error detection or correction by redundancy in data representation, e.g. by using checking codes

Definition statement

This subgroup covers:

Documents where the error detection/correction in a computer system is done by redundancy in the representation of the data.

Most often this redundancy arises from the fact that more bits are used to represent the data than strictly necessary. However, these groups cover as well cases where the data is stored twice, but in different formats (e.g. the second time using inverse logic).

However, subject-matter where 2 (or more) identical copies of the data are stored, is not treated here (see informative references)

References relevant to classification in this group

This subgroup does not cover:

Data with redundancy of data representation stored on storage with movable components	G11B 20/18
Error detection or correction codes per se	H03M 13/00
Transmission of data using redundancy of data representation	H04L 1/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Redundant storage of data	G06F 11/1666 , G06F 11/2053
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Special rules of classification within this group

Generally only 1 class is given. Only invention information is classified.

G06F 11/10

Adding special bits or symbols to the coded information, e.g. parity check, casting out 9's or 11's

Definition statement

This subgroup covers:

Subject matter where more bits are used to represent the data than strictly necessary, however without representing the data twice (or more often).

Subject-matter dealing with host-to-memory or host-to-host transfers is classified in this group per se, except when when the protection is on the level of blocks of data (which is in [G06F 11/1004](#)).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Protecting a block of data words	G06F 11/1004
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Special rules of classification within this group

As soon as the redundant representation is stored on storage, the subject-matter should be classified in [G06F 11/1076](#) and subgroups and not in other subgroups. This is independent of how the redundant representation is determined or what representation is used. Group is not used for classification.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Memory	solid state devices used as main memory which are either directly addressable by the associated CPU (meaning that they are located on the high speed bus), or are not addressable internal memories (such as registers and buffers). As such, memory is different from storage.
Storage	media from which data needs first to be loaded before it can be used for computing.

G06F 11/1004

{to protect a block of data words, e.g. CRC or checksum ([G06F 11/1076](#) takes precedence; security arrangements for protecting computers or computer systems against unauthorized activity [G06F 21/00](#))}

Definition statement

This subgroup covers:

The use of checking codes on bigger units of data than a single word to detect the presence of errors in the data.

This group does not cover correction of data.

In this group, it is irrelevant for what purpose the checking is being used (e.g. for storing the data in memory, for transmission of the data to another component in the computing system, ...) as long as it is related to error detection.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Security arrangements for protecting computers or computer systems against unauthorized activity	G06F 21/00
Computer virus detection or handling	G06F 21/00
Using checking codes for detecting unauthorised modifications	G06F 21/00
Using checking codes in data communication	H04L 1/00

G06F 11/1008

{in individual solid state devices ([G06F 11/1004](#) takes precedence)}

Definition statement

This subgroup covers:

That subject-matter where the error detection and/or correction is done on data stored in a single solid state device (i.e. the detection/correction is done when reading data from or writing data into the memory). It is independent of what function the solid state device has in the system. The relevant criterium is the type of component on which the data is stored (i.e. solid state devices in contrast to disks, tapes or other storage devices with moving components).

References relevant to classification in this group

This subgroup does not cover:

To protect a block of data words	G06F 11/1004
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Protection of blocks of data being transferred (from memory to memory or between host and memory)	G06F 11/10
Parity RAID in storage	G06F 11/1076

Special rules of classification within this group

[G06F 11/1004](#) takes precedence.

G06F 11/1012

{using codes or arrangements adapted for a specific type of error
([G06F 11/1048](#) takes precedence)}

Definition statement

This subgroup covers:

This group and its subgroups cover specific code arrangements, i.e. documents describing how the ECC codes to be applied to the data are determined. As an example, documents describing row and column parity are classified here

Special rules of classification within this group

[G06F 11/1048](#) takes precedence.

G06F 11/1016

{Error in accessing a memory location, i.e. addressing error}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Protection against unauthorized access to memory	G06F 12/14
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G06F 11/1024**{Identification of the type of error}****Special rules of classification within this subclass/group**

Not used for classification.

G06F 11/1032**{Simple parity}****Special rules of classification within this subclass/group**

Not used for classification

G06F 11/1036**{Unidirectional errors}****Special rules of classification within this subclass/group**

Not used for classification.

G06F 11/1044**{with specific ECC/EDC distribution}****Definition statement***This subgroup covers:*

ECC codes where different bits of a data word are stored in different memory modules. Documents classified here, do not deal with calculation of ECC/EDC but only on where the data with the corresponding code is stored in the device (e.g. on different modules of the same device).

Informative references*Attention is drawn to the following places, which may be of interest for search:*

Parity distribution in a Redundant Array of Independent storage devices	G06F 11/108
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Special rules of classification within this group

Only classify here when no other group applies.

[G06F 11/1012](#) (code arrangements) takes precedence.[G06F 11/1048](#) (hardware arrangements) takes precedence.

G06F 11/1048

{using arrangements adapted for a specific error detection or correction feature}

Definition statement

This subgroup covers:

This group and its subgroups cover coding where the hardware plays a role, e.g. to make the error correction or detection faster, to reduce the power consumption for detecting/correcting errors, ...

The hardware involved must be described.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Parity in RAID systems	G06F 11/1076
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G06F 11/1052

{Bypassing or disabling error detection or correction}

Definition statement

This subgroup covers:

This group covers documents in which no error detection/correction by redundant coding is performed at all in the normal situation.

Relationship between large subject matter areas

Subject-matter covering circuits where ECC/EDC codes are calculated in parallel during operation are to be classified in [G06F 11/1048](#).

G06F 11/1056

{Updating check bits on partial write, i.e. read/modify/write}

Special rules of classification within this subclass/group

Not used for classification.

G06F 11/106

{Correcting systematically all correctable errors, i.e. scrubbing}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Memory refresh techniques	G11C
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G06F 11/1064

{in cache or content addressable memories}

Definition statement

This subgroup covers:

This group covers ECC when it concerns a feature which is specific to caches or content addressable memories.

For instance if an additional ECC is used for the cache with respect to the memory.

G06F 11/1068

{in sector programmable memories, e.g. flash disk ([G06F 11/1072](#) takes precedence)}

References relevant to classification in this group

This subgroup does not cover:

[G06F 11/1072](#) takes precedence

Special rules of classification within this group

[G06F 11/1072](#) takes precedence

Documents classified in this group should be sent to [G11C 29/00](#) as well.

G06F 11/1072

{in multilevel memories}

Definition statement

This subgroup covers:

Covers all subject-matter related to memories of which the cells can store more than 2 values.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Architectural details of multilevel memories	G11C
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Special rules of classification within this subclass/group

Documents classified in this group should be sent to [G11C 29/00](#) as well.

G06F 11/1076

{Parity data used in redundant arrays of independent storages, e.g. in RAID systems}

Definition statement

This subgroup covers:

Redundancy using parity calculation and stripping in redundant arrays of storage devices such as :

- Hard Drives (e.g. RAID)
- Semiconductor memories (e.g. RAID of SSD/Flash disks)
- Optical Drives (e.g. RAID in ODD archives)
- Tape (e.g. RAIT)

Relationship between large subject matter areas

Mirroring in RAID: [G06F 11/2053](#)

Use of parity in memories which do not constitute a redundant array and are close to the processor (e.g. ECC or arithmetic code in a semiconductor memory on the high speed bus): [G06F 11/1008](#)

References relevant to classification in this group

This subgroup does not cover:

Control as such of RAID system	G06F 3/0604
Mirroring	G06F 11/2053
Redundancy on a disk used for reproduction	G11B 20/1833

Special rules of classification within this group

If the document can be classified in a subgroup of the [G06F 11/1076](#), then it should not appear in the head subgroup. Only those documents which cannot be classified in one or several subgroups (e.g. [G06F 11/108](#), [G06F 11/1084](#) etc) have to be classified in the head subgroup.

It is important to evaluate whether the parity calculation aspect is present and if specifics about fault recovery / rebuilding are present in the document. If such topic is not present or if the document talks about general parity aspects mixed with other topics, the Indexing Code groups should be used.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

RAID	Redundant Array of Independent Disks is a technique for implementing fault tolerance in storage devices.
Rebuild	Action of regenerating lost data from redundant data present in available drives / memories.
JBOD	Just a Bunch Of Disks represent a group of disks without particular redundant scheme implemented.

G06F 11/1084

{Degraded mode, e.g. caused by single or multiple storage removals or disk failures}

Definition statement

This subgroup covers:

Using the parity to reconstruct data which would otherwise have been lost when a storage device is failing or is removed.

When the reconstruction takes place once a new disk is available, [G06F 11/1092](#) subgroup is used.

When the reconstruction takes place on a spare disk that was available, [G06F 11/1088](#) subgroup is used.

References relevant to classification in this group

This subgroup does not cover:

Actual replacement of a failing disk	G06F 11/16
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

RAID	Redundant Array of Independent Disks is a technique for implementing fault tolerance in storage devices.
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G06F 11/14

Error detection or correction of the data by redundancy in operation
([G06F 11/16](#) takes precedence)

Definition statement

This subgroup covers:

Although not fully consistent with the title of this group we consider that prophylactic additional saving-related measures like check-pointing, backing-up or state copying, which are performed before the occurrence of a fault in order to be able to recover or restore (at least partially) in case a fault occurs in the future, and which do not rely on hardware redundancy, are to be classified under this group.

The corresponding reverse operations of restoring and/or recovering and/or rolling back fit in naturally, since these are performed after the occurrence of a fault. The same holds for any type of redoing. All these activities are considered particular cases of error correction.

Retrying an operation may be part of an error detection mechanism when used in conjunction with a counting or time-out scheme. It may constitute an error correction when it is used to overcome a transient error. In both cases it is a mechanism used after the occurrence of a fault.

Special rules of classification within this subclass/group

In this group the use of the Indexing Codes [G06F 2201/00](#) and lower is mandatory.

G06F 11/1402

{Saving, restoring, recovering or retrying}

Definition statement

This subgroup covers:

The techniques covered by [G06F 11/1402](#) imply at least an attempt to correct an error. They do not cover the detection as such, which may be found in [G06F 11/1497](#) or [G06F 11/1479](#).

Special rules of classification within this group

Classification of documents relating to snapshots is done as follows :

- documents describing the use or creation of snapshots to deal with the detection or correction of errors are classified in [G06F 11/00](#), and normally in subgroups of [G06F 11/1402](#).
- documents describing other uses of snapshots (or creation of snapshots for such purposes) are not classified in [G06F 11/00](#). They are classified in [G06F 17/30](#) or [G06F 3/06](#) unless the specific use is provided for in another classification place.
- General-purpose treatment of snapshots (e.g. management of valid snapshots, determining not needed snapshots, storage optimisation, ...) is dealt with in [G06F 17/30](#) if the snapshots are on file level. If the snapshots are volume-based snapshots, they are dealt with in [G06F 3/00](#) since they concern the management of storage space in this case.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Persistent data	Data which are still relevant after a normal power off/ power on cycle or a logoff/logon procedure. Typically, the user determines when such data should be modified or destroyed (since they are not relevant anymore). Thus, persistent data is not equivalent to data that is stored in a non-volatile manner, the latter merely giving an indication of the type of memory/storage used to save the data. Non-volatile data does not need to be persistent, but persistent data is always non-volatile.
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G06F 11/1405

{at machine instruction level}

Definition statement

This subgroup covers:

Measures taken inside the processor or relating to individual processor instructions. To implement these measures, additional hardware (such as registers) can be used. A necessary condition to classify here, is that the operating system is unaware of the measures taken.

G06F 11/1415

{at system level}

Definition statement

This subgroup covers:

The solution of a specific problem related to the functioning of the computer system(s) as a whole in contrast to a particular application functionality. It is intended to cover firmware level (e.g. BIOS), OS level, file system level and/or utilities.

Relationship between large subject matter areas

This group is NOT intended to include database specific techniques. Note that if the solutions in these groups involve the use of particular software techniques covered in [G06F 11/1479](#) /low, the documents should be classified there as well. See e.g. the comment under [G06F 11/1438](#) relating to additional classification in [G06F 11/1479](#).

G06F 11/1417

{Boot up procedures}

Definition statement

This subgroup covers:

Restricted to correction (attempt) of errors during or using the boot process.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Reboot as part of upgrading to verify the successful upgrade	G06F 11/1433
Bootting in general	G06F 9/4401

G06F 11/142

{Reconfiguring to eliminate the error (group management mechanisms in a peer-to-peer network [H04L 67/1044](#))}

Definition statement

This subgroup covers:

Reconfiguration meaning that the system undergoes modification of the components that make up the system or their arrangement in response to an error being detected. The components can be either hardware or software components.

Example:

- The system switches to a minimal video driver in case the normally used video driver does not give any image anymore.

Counterexamples:

- redistributing the load on individual processors of a multiprocessor system in an overload condition
- masking faults by reconfiguring redundant hardware (e.g. making a standby component primary, changing the role of disks in a mirrored pair, ...)

References relevant to classification in this group

This subgroup does not cover:

Checking for a new version of software when a failure occurs with the current version	G06F 11/0793
Software update in general	G06F 8/65

G06F 11/1423

{by reconfiguration of paths}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Isolating a faulty entity in a communication network	H04L12/24D3A
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G06F 11/1433

{during software upgrading}

Definition statement

This subgroup covers:

Potential to recover from errors during or after software update or upgrade or installation processes. Also applies when this process is performed by a specific update/install software or even by the application itself.

G06F 11/1435

{using file system or storage system metadata}

Definition statement

This subgroup covers:

There is redundancy in the metadata used to access a given stored data item.

Examples are :

- File systems having redundant FATs or redundant tuples
- Redundant CMOS/BIOS data defining the disk layout

Counterexamples are :

- Retry a read from a disk sector by the disk controller when the read fails. This should be classified [G11B 20/00](#)
- Retrying the disk I/O request by the CPU. This should be classified in
- [G06F 11/1443](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

File management in general	G06F 17/301
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G06F 11/1438

{Restarting or rejuvenating}

Definition statement

This subgroup covers:

The act of restarting a software module (e.g. an application, but not the complete OS, because this would imply a boot process which is covered in [G06F 11/1417](#)) either to recover from an error or in order to prevent an error (the latter being rejuvenation). The restarting or rejuvenating may be based on a previous state saving of the software module. Usually, this is based on a previously saved dynamic state of the software module. The dynamic state of a software application or process or task includes at least some of stack, heap, open files, etc. information, from which the application can later continue processing. Continuing from a previously saved state without full application restart is also covered by this group.

Special rules of classification within this group

If the application restart or rejuvenation mechanism is implemented in an OS or middleware layer outside the application, this aspect is to be additionally classified in [G06F 11/1482](#).

G06F 11/1441

{Resetting or repowering}

Definition statement

This subgroup covers:

Measures taken out of a normal operating mode (after boot) but before abnormal termination of the system to enable a machine to continue processing from a defined state after a re-initialisation (reset or re-powering) of the machine. Example: power is monitored, when voltage drop is detected, the RAM is saved to disk. After power restore, RAM is reloaded from disk. Or, battery used to temporarily backup the RAM during a (short) power outage.

Without error see [G06F 1/3203](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Means for saving power	G06F 1/3203
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Special rules of classification within this group

If a spare power supply is used, additionally [G06F 11/2015](#) must be given (either as additional or invention, depending on the circumstances)

G06F 11/1443

{Transmit or communication errors}

Definition statement

This subgroup covers:

Examples :

- printer or disk I/O retry by the Operating System.
- Repeated requests by a client to the server

Informative references

Attention is drawn to the following places, which may be of interest for search:

Detecting errors in the information received	H04L 1/00
Error detection mechanisms part of a communication protocol	H04L 12/00 , H04L 29/00

Special rules of classification within this group

Documents should only be classified here when they concern transmit or communication errors and where the mechanisms used are not part of a communication protocol and no other group of [G06F 11/14](#) and subgroups or [G06F 11/16](#) and subgroups applies.

G06F 11/1446

{Point-in-time backing up or restoration of persistent data}

Definition statement

This subgroup covers:

Backup done either on file or data block level. Covers, backing up of any type of file, independent of the data it contains.

Note: Due to considerable overlap in technology, backups and data backup systems frequently are confused with archives and fault-tolerant systems. However:

- Backups differ from archives in the sense that archives are the primary copy of data whereas backups are a secondary copy of data.
- Data backup systems differ from fault-tolerant systems in the sense that data backup systems assume that a fault will cause a data loss event, whereas fault-tolerant systems do not.

The scope of this group also covers ensuring that the data to be saved (as backup copy) is consistent (i.e. represents a meaningful state), especially if the copy is made of data within a distributed system.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Data archiving	G06F 17/30067
Data replication	G06F 11/1658 , G06F 11/2094 , G06F 11/2097 , G06F 17/30
Mirroring	G06F 11/2056

G06F 11/1448

{Management of the data involved in backup or backup restore}

Definition statement

This subgroup covers:

All operations related to data management which are used for the backup data.

Examples of management of the data that is backed up :

- managing versions of backups
- formatting for compatibility with different systems
- consolidation of backed up data

Informative references

Attention is drawn to the following places, which may be of interest for search:

File management in general	G06F 17/301
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Special rules of classification within this group

Documents relating to authorisation control or data security of the backups should also be sent to [G06F 21/00](#) for classification

G06F 11/1451

{by selection of backup contents}

Definition statement

This subgroup covers:

- any determination of what data should be subjected to backup (e.g. what type of data, which origin of data, according to criticality of the data, ...)
- determining the necessity to include particular data (e.g. based on whether the data has changed)
- in what form the data should be backed up (e.g. incremental backup, full backup, differential backup, ...)

G06F 11/1453

{using de-duplication of the data}

Definition statement

This subgroup covers:

all techniques that are used to detect multiple copies of data items (e.g. files, data blocks, strings of data, ...) and to use this knowledge to optimize the backup (e.g. by not retransmitting the detected item, by not storing the detected item twice,...).

This is irrespective of whether the multiple copies are between (backups of) data at different times or between (backups of) different data items having a part in common or between (backups from) different hosts.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Redundancy elimination in general	G06F 17/3015
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G06F 11/1456

{Hardware arrangements for backup}

Definition statement

This subgroup covers:

subject-matter where the hardware arrangement is affected by its use as backup system or where a particular system arrangement is proposed for backup. However, this does not imply that a particular hardware component must be physically modified for backup purposes

The following are some examples :

- additional (temporary) memory or storage is used to enable efficient writing on the backup medium
- storage which is configured to automatically perform a backup, when connected to a system to be backed up.
- A specific type of hardware being used for backup

A distributed architecture where some processing nodes are dedicated to particular backup functions

Further details of subgroups

G06F 11/1458

{Management of the backup or restore process}

Definition statement

This subgroup covers:

All operations related to the management of the backup process.

Examples are :

management of backup process :

- how to make the backup process faster
- avoiding data restoration by unauthorized persons

Special rules of classification within this group

In this group the use of the Indexing Codes [G06F 2201/00](#) and lower is mandatory.

Documents relating to authorisation control or data security of the backups should also be sent to [G06F 21/00](#) for classification

G06F 11/1464

{for networked environments}

Definition statement

This subgroup covers:

Everything relating to arrangements in which the distributed architecture is of importance for the backup. Examples: Optimizing bandwidth, selecting machines (source or target) for backup, time multiplexed scheduling of backup clients, hierarchical distribution of backup control functionality to different networked machines.

G06F 11/1466

{to make the backup process non-disruptive}

Definition statement

This subgroup covers:

All subject-matter dealing with techniques of limiting the impact of the backup process on normal operations, e.g. by minimizing the backup window.

G06F 11/1469

{Backup restoration techniques}

Definition statement

This subgroup covers:

Problems relating to restoring data from a backup using a backup/restore application (in contrast to data movement services of an OS). Examples: Finding and ordering the necessary tapes, handling a target format that is no longer the same as the original one, target system configuration has changed and new locations must be determined, improving restore efficiency.

Relationship between large subject matter areas

Data migration from one machine to another one	G06F 3/0646 G06F 17/30 .
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G06F 11/1471

{involving logging of persistent data for recovery}

Definition statement

This subgroup covers:

Logging techniques or the usage thereof for the purpose of attempting to recover from errors.

Ensuring that a log contains all necessary data to enable a restore.

Maintenance of the logged data (e.g. pruning obsolete entries to reduce the recovery time).

References relevant to classification in this group

This subgroup does not cover:

Journaling used as a data transmission mechanism for asynchronous mirroring Creating a consistent baseline of stored data for recovery to avoid long log processing at restore time is to be classified in other parts of	G06F 11/14 G06F 11/2094 .
Journaling for asynchronous mirroring	G06F 11/2074

Informative references

Attention is drawn to the following places, which may be of interest for search:

Logging in general	G06F 17/30
Logging in database systems	G06F 17/30286

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Logging	recording physical or logical changes to stored persistent data to allow a system to recover from crashes or other errors and maintain the stored persistent data in a consistent state.
Journal	is a chronological record of data processing operations. It is considered equivalent to logical logging.

G06F 11/1474

{in transactions ([G06F 17/30286](#) takes precedence)}

Definition statement

This subgroup covers:

general recovery techniques of transactional systems; detailed techniques of transaction processing in database systems (e.g. ensuring ACID properties of updates in database systems) are not classified here.

Attempting to recover from errors within transactions that create/update/modify data. The term transaction is understood broadly.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Making database transactions atomic	G06F 17/30286
Transactional file systems	G06F 17/30067
Error recovery for (main) memory accesses implemented as transactions	G06F 11/141

Special rules of classification within this group

Documents being classified here that concern transactions in database management systems should be sent to [G06F 17/30286](#) for classification as well.

G06F 11/1479

{Generic software techniques for error detection or fault masking}

Definition statement

This subgroup covers:

All techniques implemented by software means, i.e. where the fault tolerance does not result from the hardware and is not bound to a particular redundant hardware architecture.

Software architectures and structural approaches independent of the particular problem solved or function that is achieved. As a consequence, documents describing such technique for a particular purpose or hardware architecture as covered by the subgroups of [G06F 11/14](#) and [G06F 11/16](#) should be classified there as well. As a particular example for this see the comments under [G06F 11/1482](#) relating to additional classification in [G06F 11/1438](#).

Documents where the kind of fault tolerance used (active-active, voting, active-passive, ...) is fixed by the hardware architecture and cannot be influenced by the software, should not be classified in this group.

Examples are: Fault-tolerance using data-diversity (e.g. by using different equivalent input data sets for each retry of a function), corrective actions e.g. following a plausibility check. Other examples include measures taken before run time (e.g. duplication of instructions for comparison at compile time) or robust data structures (see XP745785).

Counterexample : the operating system for a Tandem Himalaya system will not be classified here, because it is bound to a hardware architecture that provides the fault tolerance and it does not employ any of the generic techniques covered by [G06F 11/1479](#).

G06F 11/1482

{by means of middleware or OS functionality}

Definition statement

This subgroup covers:

There is a software layer (on top of the operating system or integrated in the operating system) which makes applications which are not fault-tolerant run in a fault tolerant way. Typically, this is done by scheduling requests of the application more than once.

A typical example of this is fault tolerant cluster software.

Another example is an OS that detects a faulty process and creates a further copy of the same process on the same processor (but potentially in another memory area).

Special rules of classification within this group

If the layer implements an application restart or rejuvenation mechanism, this feature is to be additionally classified in [G06F 11/1438](#).

Documents where there is necessarily some hardware redundancy, get an Indexing Code as well in the HW redundancy groups.

Documents which describe said middleware/OS technique in combination with only one redundant hardware architecture always go into the [G06F 11/16](#) and subgroups, but where said technique is explicitly suitable for other redundant hardware architectures, they are classified in [G06F 11/1482](#) as well.

The restart related aspect of the second example is to be classified additionally in [G06F 11/1438](#).

Note that [G06F 11/1482](#) as such does not imply failover mechanisms, although the underlying hardware becomes redundant because of the software layer. Hence, this hardware redundancy aspect requires classification as well, in this particular case in [G06F 11/2023](#) (example docs: US2003018927, US2003105852).

G06F 11/1487

{using N-version programming}

Definition statement

This subgroup covers:

For error detection the output of multiple versions (typically based on different source codes) of the application code or portions thereof are compared or voted (note that this is different from an acceptance test as defined in [G06F 11/1489](#)). This can be in different programming languages, different compilers or implementation of alternative algorithms. The versions may be executed sequentially, concurrently or in parallel on different hardware (thereby making the latter redundant).

G06F 11/1489

{through recovery blocks}

Definition statement

This subgroup covers:

For error detection an acceptance test (mostly a plausibility check or a limit on execution time) is performed on critical code blocks. If the test is not passed, the output of another execution of the same or an alternative version of the block is used for recovery. The executions may be sequential or parallel. Note that an acceptance test is performed using the output of only one of the executions.

Special rules of classification within this group

If the other execution is systematically performed on the same hardware, this has to be additionally classified in [G06F 11/1497](#).

G06F 11/1492

{by run-time replication performed by the application software}

Definition statement

This subgroup covers:

In contrast with [G06F 11/1482](#), here the redundancy is inherent in the application itself. Thus, the application does not rely on any other layer to be fault-tolerant. The redundant portions are necessarily identical, since otherwise the redundancy is not realized at runtime, but is hard coded.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Replication implemented at OS- or middleware level is covered by	G06F 11/1482
N-modular type	G06F 11/1494
Details of time redundant execution on a single processing unit	G06F 11/1497

G06F 11/1494

{N-modular type}

Definition statement

This subgroup covers:

Using comparison or voting for the concurrently running replicas of the application software.

G06F 11/1497

{Details of time redundant execution on a single processing unit}

Definition statement

This subgroup covers:

A piece of software (module, function, complete application, ...) is always executed two or more times sequentially or concurrently (e.g. as threads) on a single processing unit in order to address transient faults. In particular, this groups covers those aspects relating to the provision of the identical input to all executions of the software. When more than two execution are foreseen this can be used for error correction (not only detection). In particular, this group covers the techniques used to instantiate multiple executions of redundant software, the temporary storage of intermediary results or the duplication of contexts for each instance, as well as the measures taken for the subsequent error detection or fault masking. Note that this group also covers (non-redundant) hardware support for time redundant execution and, thus, cannot be a subgroup of [G06F 11/1479](#).

G06F 11/16

Error detection or correction of the data by redundancy in hardware

Definition statement

This subgroup covers:

- Systems where hardware redundancy is used to detect errors or to correct errors based on the output produced by the redundant components.

Relationship between large subject matter areas

There are three types of hardware redundancy that can be found here:

The hardware redundancy is used for error detection only: such systems imply that there are at least (and normally only) two redundant components, which are both active, the output of which is compared ([G06F 11/1608](#), [G06F 11/1629](#)). Disagreement indicates an error.

The hardware redundancy is used for error detection and correction: such systems imply that there are at least three redundant components, which are all active, the output of which is voted. In the presence of an error the majority of correct outputs is used to correct the error. Since this is done without reconfiguration of the system, i.e. by ignoring the erroneous component(s), this is called passive fault masking ([G06F 11/18](#)).

The hardware redundancy is used for error correction only: such systems imply that there are at least one active component and at least one passive component suited to replace the active one in case the latter is failing. The detection of the failure is not (necessarily) based on hardware redundancy, however the correction of the error is. It requires a reconfiguration of the system as a result of which the functionality of the failing component is switched over to a spare (failover, takeover). This is called active fault masking ([G06F 11/20](#)).

In this context, voting and comparing are decision processes as to the correctness of the output of the system. This is in contrast to membership determination processes (which may also use majority building), which concern decisions on what the configuration of a system should be.

Testing of redundant computer hardware justifies an Indexing Code in appropriate subgroups of [G06F 11/16](#). Testing of non-redundant but identical computer hardware (e.g. on a wafer) using comparison or voting techniques is [G06F 11/22](#) only. Verifying components against a "golden master" is neither run-time nor fault-masking, this it is not [G06F 11/16](#) but [G06F 11/22](#) or [G01R 31/00](#).

The subgroups fall apart in 2 types :

- "architectural groups", i.e. groups that specify constructional elements (i.e. [G06F 11/1608](#) and [G06F 11/1629](#))
- "functional groups", i.e. groups that define a particular functionality that is independent of the architecture (i.e. [G06F 11/1666](#) and [G06F 11/1675](#)). These groups may be relevant for any type of hardware redundancy or fault masking.

Redundant hardware is a prerequisite to correct permanent (hardware) faults, but is equally successful with transient faults. Thus, [G06F 11/18](#) and [G06F 11/20](#) provide mechanisms that can successfully deal with both types of faults.

- Active fault masking implies a reconfiguration and, thus, a retry in the new configuration for the operation (or set of operations) that encountered the error. Otherwise there would not be error correction. Hence, to avoid double classification of (at least) all documents in [G06F 11/20](#) there is the precedence rule under [G06F 11/14](#).

Examples:

- Not every (symmetric) multiprocessor is redundant per se, because criteria (A) is not necessarily true. However, additional error detection and reconfiguration functionality typically implemented in software (OS or application level) could be used to make processors operate redundantly.
- A point-to-point connection that initialises to use as many parallel lanes as possible and automatically reconfigures itself to use less lanes following an error implies redundant communication media, because criteria (A) and (B) are both true.

See definitions in [G06F 11/2002](#) and subgroups regarding redundancy in communications.

Special rules of classification within this group

In this group the use of the Indexing Codes [G06F 2201/00](#) and lower is mandatory.

Documents dealing with replication are classified in [G06F 11/16](#) and subgroups (in particular in [G06F 11/2094](#) and ([G06F 11/2097](#) or [G06F 11/1658](#)) only when the purpose of the replication is for error handling or error detection. If the use is another one (e.g. performance or load balancing) or is not disclosed, the document should be classified in [G06F 17/30067](#) instead.

Some systems having a set of equivalent/similar hardware resources all used under normal conditions may be reconfigured in response to an error to use only a subset of these resources while still providing the same full logical functionality, however possibly with degraded performance.

In order to decide where such documents are to be classified, the following criteria are used:

- (A) If a reconfiguration mechanism is used following the error detection, we are in the presence of error correction using active fault masking.
- (B) If said mechanism is able to correct permanent hardware faults, this implies the presence of some form of redundancy in hardware.

If both criteria apply, the subject-matter is for [G06F 11/20](#): A AND B => [G06F 11/20](#).

Note in particular that:

[G06F 11/14](#) (redundancy in operation) provides mechanisms that can ONLY deal successfully with transient faults.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Redundant hardware	additional hardware for performing the same function as another hardware part, provided that in faultless operation you could renounce on either hardware parts of the system without losing functionality.
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G06F 11/1604

{where the fault affects the clock signals of a processing unit and the redundancy is at or within the level of clock signal generation hardware}

Definition statement

This subgroup covers:

- Systems with multiple clock generating components with active or passive fault masking, i.e. where the system is continuously clocked even in the presence of failing clock generators.
- Single clock generators that are fault tolerant in themselves, e.g. by comprising multiple oscillators.
- Arrangements that only detect clock faults based on redundancy at or in the clock generating level (typically by comparing signals output by two clock generators).
- The symbols [G06F 11/1608](#), [G06F 11/18](#) and [G06F 11/20](#) are to be used where appropriate to capture the type of mechanism implementing the clock fault tolerance, if no EC symbol in the respective field is already given.

Note that this group does not require, that the clocked system itself is fault-tolerant.

References relevant to classification in this group

This subgroup does not cover:

Clock signal generation circuits/techniques as such even when redundancy is involved within such circuits	G06F 1/04
Appropriate clock signal distribution on ICs or between discrete components	G06F 1/10
Clock (phase) synchronisation in general, even when used to ensure the synchronous operation of multiple processors	G06F 1/12

Measures taken at clock level to achieve lockstep operation of redundant processing components	G06F 11/1679
Synchronisation of processor clocks representing time (time of day, logical/virtual time, real time clocks; NTP, PTP, UTC)	H04J 3/0635
Time of day; time pieces	G04G
Oscillators, pulse generators or clock synthesizers	H03K
Oscillators, pulse generators or clock synthesizers if a loop is involved	H03L 7/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Fault-tolerant synchronisation of clocks representing time	G06F 11/1479
Error detection by comparing the output signals of redundant hardware	G06F 11/1608
Checking static stores for correct operation is	G11C 29/00

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Clock signal	designates the common periodic square-waved signal on which synchronous digital components base their operations. This signal does not represent any absolute or relative real, logical or virtual time value (although such time may be derived therefrom by counting periods of this clock signal).
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Computing-related hardware the run-time behaviour of which is not controlled by software (e.g. ALUs, counters, decoders, ...). As soon as the redundant hardware under consideration, the output of which is compared, comprises a software programmable processor ((micro-)controller, CPU, microprocessor, ...), this should go to the [G06F 11/1629](#).

Comparing is understood largely, i.e. it encompasses coherency checks (are the compared results similar enough to be considered the same or equivalent?) not only identity tests.

Processor(s) comparing the input from redundant sources (like buffers) are [G06F 11/1608](#) as long as they do not compare their own results. The latter would have to be additionally classified in [G06F 11/1629](#).

G06F 11/1629

{Error detection by comparing the output of redundant processing systems}

Definition statement

This subgroup covers:

This group is intended to contain systems in which the redundant components are programmable (hardware) processors, the runtime behaviour of which is defined by software/firmware.

Comparing is understood largely , i.e. it encompasses coherency checks (are the compared results similar enough to be considered the same or equivalent?), not only identity tests.

Relationship between large subject matter areas

FPGAs are programmable in respect of their configuration only. In general, the resulting run-time functionality thereof does not constitute a software controllable processor, thus systems comprising redundant FPGAs, the functionality of which is not run-time programmable, should be in **16B**, as long as they form part of computer hardware.

Comparisons of input values are not to be classified here. They may, however, be for [G06F 11/1608](#) as long as said input is produced by redundant sources. If such a comparison is used to detect errors in the transmission of data, this should be [H04L 1/00](#). Redundant sources like sensors may be [G05B](#) rather than [G06F](#) (see also comments of [G06F 11/1616](#)).

G06F 11/1633

{using mutual exchange of the output between the redundant processing components}

Definition statement

This subgroup covers:

This group is intended to comprise systems in which there is no comparator hardware. Instead, all redundant components send their respective output results to each other and each perform the comparison (in software) between their own output and the one(s) received from the other redundant components. This would cover processors exchanging results via a local (processor) bus as well as distributed system which communicate the results via LAN or other type of network.

Relationship between large subject matter areas

- If there are more than 2 redundant units, this group applies only as far as there is no fault masking (this would be [G06F 11/18](#)).
- Redundant hardware comparators distinct from but directly associated with the redundant processing components go into [G06F 11/1645](#).

G06F 11/1637

{using additional compare functionality in one or some but not all of the redundant processing components}

Definition statement

This subgroup covers:

- Consists of systems often denoted as master/checker in which there is no separate comparator unit. Instead, one or some of the redundant unit(s) (the checker(s)) do(es) additional work to perform the comparison, thereby detecting erroneous behaviour and checking the system for correct operation. The additional compare functionality may be implemented in hardware on the corresponding processing component(s), or in software executed by the corresponding processing component(s).
- Master/checker type architectures in which two processors operate in clock lockstep, where the checker compares the values driven by the master with its own corresponding internally present by otherwise disabled outputs. If a discrepancy is detected, the checker produces an error signal. See the glossary for citations of example master-checker structures. Note that this type of architectures also falls in the [G06F 11/1654](#).
- Master/checker architectures where the checker is limited in processing functionality with respect to the master, even though this is not absolutely in line with our definition of hardware redundancy.

G06F 11/1641

{where the comparison is not performed by the redundant processing components}

Definition statement

This subgroup covers:

Here one or more hardware units separate from the redundant components are used to compare the results produced by the redundant components. Further details of subgroups

[G06F 11/1645](#) and the comparison itself uses redundant hardware

This covers architectures in which there are comparator units (typically but not necessarily respectively associated with but) distinct from each one of the redundant processing components. The comparators are considered redundant when they perform the same comparison on (copies of) the same signals/data.

G06F 11/165

{with continued operation after detection of the error}

Definition statement

This subgroup covers:

Documents in which an additional mechanism is provided to determine which one(s) of the redundant component(s) shall survive after the detection of the error. This may (but need not) involve a determination of which component is correct, in which case this redundant component can be used to correct the error in the other one(s) such that all redundant processing components can finally continue their operation.

Relationship between large subject matter areas

However, since they are not based on a majority decision, (otherwise they would be [G06F 11/18](#), see in particular [G06F 11/181](#)), the determination of the surviving component(s) is usually not done using redundancy in hardware. Rather, some diagnostics or simple priority rules, possibly based on prior behaviour are used.

Special rules of classification within this group

Techniques in this group may use active fault masking, passive fault masking (i.e. ignoring the faulty component), or other techniques like retry. If these are described they should get an Indexing Code in the respective field as well.

G06F 11/1654

{where the output of only one of the redundant processing components can drive the attached hardware, e.g. memory or I/O}

Definition statement

This subgroup covers:

- Here one of the processing components is usually called the "master", the other(s) may be denoted as slave(s), checker(s), or shadow(s). The master's: outputs drive the system. The slave's: outputs are used for comparison but are otherwise disabled from reaching other components of the system.
- Architectures in which both processors have a master and a slave role but for distinct parts of the system, i.e. for different types of output.

Relationship between large subject matter areas

There may be an overlap of this group with [G06F 11/1637](#) when the slave itself also performs the comparison, thereby making it a checker as well.

Special rules of classification within this group

This group should only be used when there effectively is an asymmetry in the role of the redundant processors. On the contrary, the mere statement that a comparator or bridge or the like selects the outputs of one the processors to drive the attached components does not suffice to justify a different role of the processors.

G06F 11/1658

{Data re-synchronization of a redundant component, or initial sync of replacement, additional or spare unit}

Definition statement

This subgroup covers:

The following types of data transfer activities (possibly using data replication) from a memory, the content of which is assumed to be good, to a one that is not yet current (note that the concerned memories do not need to be themselves redundant):

- sporadic resynchronisation processes used to reintegrate a redundant component into an active/active system, such process being started in an attempt to correct a fault for instance by rebooting a failing component or by replacing it.
- synchronisation processes occurring at start-up of some redundant active/active systems in which the redundant components have to negotiate when they are all ready to enter the lockstep mode of operation.
- initialisation processes used to make a redundant component ready to work as a stand-by in active/passive systems.

Special rules of classification within this group

Documents in this group describing techniques in the context of active/passive systems should additionally have at least one Indexing Code in the [G06F 11/20](#) (see also the comments in [G06F 11/2097](#)).

G06F 11/1662

{the resynchronized component or unit being a persistent storage device (re-synchronization of failed mirror storage [G06F 11/2082](#); rebuild or reconstruction of parity RAID storage [G06F 11/1008](#))}

Definition statement

This subgroup covers:

- Initialising data of a (newly activated) spare disk, provided this is not a mirror disk (the latter being in [G06F 11/2082](#)).
- Typical examples for this are the preparation of file system or database replica.
- [G06F 11/1666](#)

G06F 11/1666

{where the redundant component is memory or memory area}

Definition statement

This subgroup covers:

- The term memory is meant to comprise solid state devices used as main memory which is directly addressable by the associated CPU, as well as non addressable solid state internal memories (e.g. registers, buffers). It does however not need to be RAM.
- Redundant caches and main memory mirroring (in which case the Indexing Code [G06F 11/20](#) should be given). One of the following Indexing Codes should be used where appropriate to better characterise the fault detection or correction mechanism involved: [G06F 11/18](#), [G06F 11/20](#).
- Error detection (or fault masking) using data replicated in different areas of the same memory device is also covered.

These documents differ significantly from the other mechanisms in [G06F 11/1658](#) relating to (main) memory.

G06F 11/167

{Error detection by comparing the memory output}

Definition statement

This subgroup covers:

This the appropriate place for comparisons performed on the output of redundant memory (areas).

G06F 11/1675

{Temporal synchronisation or re-synchronisation of redundant processing components}

Definition statement

This subgroup covers:

The 16T groups address the problem of ensuring that corresponding outputs of redundant active components are simultaneously available for error detection or correction at a given time. This does not imply that these outputs are produced simultaneously (see e.g. US2002116662). Such system are frequently said to operate in lockstep (at least at some level of abstraction).

Some active/standby systems using active fault masking, where a standby unit is to be maintained in close time synchrony with its primary, the standby unit thereby effectively maintaining itself current to be ready for failover. Documents of this latter type shall also get at least an Indexing Code in [G06F 11/2097](#).

G06F 11/1679

{at clock signal level}

Definition statement

This subgroup covers:

Here systems either use a common clock (clock lockstep) or are otherwise synchronised to such an extent that they produce comparable outputs within the same clock cycle, although not necessarily exactly in phase. If not using a common clock, the synchronisation measures taken affect the clock signal.

G06F 11/1683

{at instruction level}

Definition statement

This subgroup covers:

Here we have documents where the synchronisation occurs at statically predictable places in the code either after each instruction or after each instruction of a predetermined type (e.g. memory write or I/O operation) or by using explicit synchronisation instructions/operations.

G06F 11/1687

{at event level, e.g. by interrupt or result of polling}

Definition statement

This subgroup covers:

- Synchronisation mechanisms that are triggered by events asynchronous to the main program. Typical example is synchronisation at the occurrence of an interrupt.
- Also cases in which the events are I/O operations performed in response to a polling mechanism.

G06F 11/1691

{using a quantum}

Definition statement

This subgroup covers:

Here the synchronisation process is initiated when a predetermined count (>1) of units of work is achieved.

This could be clock cycles, (selected types of) instructions, interrupts, I/O-operations, elapsed time units or any other suitable countable unit.

Special rules of classification within this group

In most cases documents should also be classified in one of the other lower subgroups of [G06F 11/1675](#)

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Quantum	A predetermined count (>1) of units of work
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G06F 11/1695

{which are operating with time diversity}

Definition statement

This subgroup covers:

Time diversity is the concept to have an active/active system in which one of the redundant components operates with a delay with respect to the other in order to avoid common mode failures that would affect both redundant components in the same way at the same time, thereby not being detectable

by comparison. Typically the time delay is a small odd multiple of the half clock period. It has to be taken into account when comparing the outputs in order to compare outputs resulting from the same logical steps, which by definition are not produced simultaneously. (Should time diversity turn out to be a concept useable for active/passive system as well, this group would have to be moved one level up).

G06F 11/18

using passive fault-masking of the redundant circuits {(error detection by comparing the output of redundant processing systems with continued operation after detection of the error [G06F 11/165](#))}

Definition statement

This subgroup covers:

- Fault masking: hiding the presence of a fault to the user or the environment of a [computer system by means of some sort of redundancy such that the perceived system functionality is not affected.
- Passive fault masking: when a system operates such that no particular action is necessary to mask a fault because all necessary operations are constantly performed independently of the presence of a fault (e.g. majority voting).

In [G06F 11/18](#) this is achieved by redundant active hardware components, the output of which is subjected to a (voting) process which ensures that only output considered correct is propagated in the system. Thereby, those redundant components which are in error are simply ignored, this resulting in a correction of the error(s) through the hardware redundancy.

Passive fault masking means that a system produces correct behaviour/ outputs in the presence of faulty components.

Voting is a majority building process, by which the output agreed upon by a majority of the redundant components is selected as the correct one, thereby tolerating any minority number of erroneous outputs.

Relationship between large subject matter areas

The subgroups fall apart in 2 types:

- "architectural groups", i.e. groups that specify constructional elements (i.e. [G06F 11/182](#), [G06F 11/183](#) and [G06F 11/184](#), [G06F 11/185](#))
- "functional groups", i.e. groups that define a particular functionality that is independent of the architecture ([G06F 11/181](#), [G06F 11/187](#), [G06F 11/188](#)).

References relevant to classification in this group

This subgroup does not cover:

With continued operation after detection of the error	G06F 11/165
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G06F 11/181

{Eliminating the failing redundant component}

Definition statement

This subgroup covers:

Documents including an elimination of a faulty component based on the results of a passive fault masking process, through which those components being in the minority are assumed to be the erroneous ones. They can, thus, be eliminated without the need for a separate fault location process. Note that this group implies that the fault masking as such is passive i.e. the correct system output can be produced before the faulty component is eliminated.

G06F 11/182

{based on mutual exchange of the output between redundant processing components}

Definition statement

This subgroup covers:

The voting process when it is performed in software by the redundant components themselves, based on their own output and the ones received from the other redundant components. There is no voter hardware.

Processors exchanging results via a local (processor) bus as well as distributed system which communicate the results via LAN or other type of network.

Redundant processing while the other groups at the same level are not.

A system having only a single redundant processing component performing the voting in software is covered as well.

References relevant to classification in this group

This subgroup does not cover:

Redundant voters distinct from but directly associated with the redundant processing components go into	G06F 11/185.
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G06F 11/183

{by voting, the voting not being performed by the redundant components}

Definition statement

This subgroup covers:

Here one or more hardware units separate from the redundant components are used to vote the results produced by the redundant components.

[G06F 11/184](#) where the redundant components implement processing functionality

Documents where the outputs of redundant processors / CPUs / microcontrollers are voted to perform the passive fault masking.

[G06F 11/185](#) and the voting is itself performed redundantly

Documents where the voting process itself is implemented using redundant hardware, i.e. where the voter does not constitute a single point of failure. The voter does not need to be implemented in hardware, but could be realised as software processes on dedicated voting processors.

Counter-example: each redundant component has a voting module in software, which uses the outputs produced by the other redundant components. This is [G06F 11/182](#).

G06F 11/187

{Details of voting}

Definition statement

This subgroup covers:

Specifics on how the voting process is performed in contrast to remaining [G06F 11/18](#) groups which relate to architectural aspects of the systems.

Relationship between large subject matter areas

This group is only used for voting for redundant hardware components. See [G06F 11/1497](#) and [G06F 11/1479](#) and subgroups for voting in the context of redundant software.

G06F 11/188

{where exact match is not required}

Definition statement

This subgroup covers:

Concerns documents where the majority is formed by outputs which are considered equivalent, although not identical. This is frequent in control applications where inputs of the redundant components do not originate from the same source of information. or where they are gained at (slightly) different times. Tolerances or other plausibility or coherence criteria may be used to determine which outputs form the majority.

G06F 11/20

using active fault-masking, e.g. by switching out faulty elements or by switching in spare elements

Definition statement

This subgroup covers:

Head-group for all documents in which faults are masked actively, i.e. after the masking is done, the fault is not present anymore in the active part of the system. It is to be noted as well that we are talking exclusively about fault masking and not about error masking.

The subgroups fall apart in 2 types :

- "architectural groups", i.e. groups that specify the constructional element which is redundant (i.e. [G06F 11/2002](#), [G06F 11/202](#) and [G06F 11/2053](#))
- "functional groups", i.e. groups that define a particular functionality that any active fault masking arrangement needs to implement (i.e. [G06F 11/2097](#)). This functionality is independent of the particular constructional element which is redundant.

Special rules of classification within this group

A general concept in the field of active fault masking is that a surviving component takes over the load/work of failing one in addition to its own normal work. For such documents the symbol [G06F 2201/85](#) should be used except for documents getting a dedicated group for this concept (e.g. [G06F 11/2035](#)).

In [G06F 11/181](#) there are also documents dealing eliminating a faulty component. [G06F 11/165](#) possibly uses active fault masking (to ensure the continued operation, some kind of decision is needed to identify one of both components as failed and this one may completely be removed from the

system). However, since in those two groups the active fault masking is rather a consequence of the voting or compare, we decided to take this particular subject-matter out of the [G06F 11/20](#).

Failover comprises one or more of the following activities:

- error detection : this is not a failover specific mechanism since there is no link between detection and failover => such docs to be classified according to the used mechanisms but not necessarily in [G06F 11/20](#)
- determination of the spare to be used
- activation of the determined spare
- declaration of the activated spare as primary
- elimination of the faulty unit

There is failover taking place as soon as any functionality of a hardware component is taken over by another hardware component, whatever the functionality is.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Fault masking	hiding the presence of an fault to the user or the environment of a computer system by means of some sort of redundancy such that the perceived system functionality is not affected.
Active fault masking	taking particular actions (e.g. reconfiguration, failover) not performed in the error free situation to mask a fault.

G06F 11/2002

{where interconnections or communication control functionality are redundant (flexible arrangements for bus networks involving redundancy [H04L 12/40176](#))}

Definition statement

This subgroup covers:

All cases where architectural components involved in communication are redundant, as long as no communication protocol layer independent of a particular application is involved.

Examples pertaining to subgroups of [G06F 11/2002](#) are:

- Duplicate connection lines
- Redundant busses (serial or parallel)

- Redundant bus controllers (e.g. PCI)
- Network interface boards describing built-in redundancy
- A redundant setup of two network adapters which are not redundant in themselves

Relationship between large subject matter areas

Fault tolerance in communications is for [H04L](#) rather than [G06F 11/00](#) if the mechanism described is implemented by a communication protocol layer that is independent of a particular application.

Examples that should be classified in [H04L](#) :

- fault tolerant FTP protocol.
- client having a session management layer, the layer independently maintaining connections with a server.
- operations relating to establishing or cancelling connections between nodes.
- message replication or retry by a routing algorithm (even fault-tolerant routing);
- dealing with transmission errors occurring on the interconnection media ([H04L 1/00](#))

Informative references

Attention is drawn to the following places, which may be of interest for search:

Recovering from network faults	H04L 12/2422
Flexible arrangements for bus networks involving redundancy	H04L 12/40176
Fault tolerant routing	H04L 45/28

Special rules of classification within this group

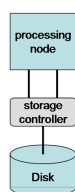
The subgroups [G06F 11/2005](#), [G06F 11/2007](#) and [G06F 11/2012](#) are to be used together in order to classify 9 different types of redundancy in this field. Regarding details of communication failover no subgroup is foreseen. This has to be searched using the other architectural criteria.

Example: Two PCs connected to a LAN by a respective LAN controller and additionally being connected to each other by a USB cable via respective USB controllers, where the USB connection can be used as alternative path to transmit the same data. This configurations gets all the three subclasses.

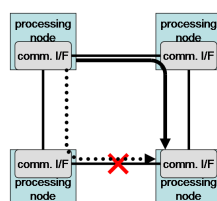
Remarks:

- A communication switch implements control logic to realise physical connections between a set of data input ports and a set of data output ports, thus, if not [H04L 49/00](#) this is [G06F 11/2005](#).
- Data transfer between processors and memories is not considered communication (rather it is addressing), hence redundant interconnects between processors and memories is [G06F 11/2002](#) (not [G06F 11/2007](#)).

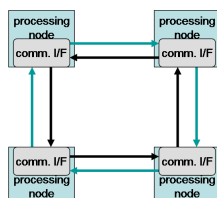
Examples below illustrate how the scheme should work in some typical situations:



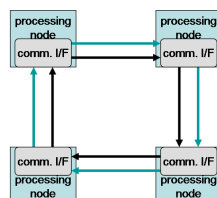
- redundant connections: 11/20C4
- Not between storage system components. (no 11/20C4S)



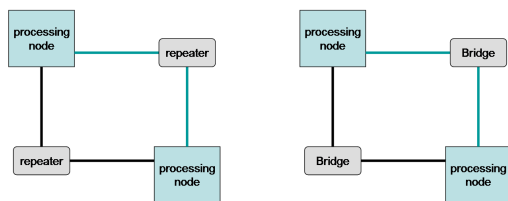
- Not 11/20C2
- Not 11/20C4
- No hardware redundancy



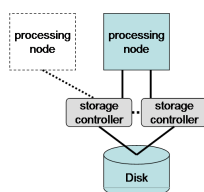
- unidirectional links, opposite direction (not same communications), no 11/20C4



- unidirectional links, same direction, redundant if used for same communications: 11/20C4



- redundant communication media: 11/20C4
- no redundant communication controllers (no 11/20C2)
- If relevant for G06F (rather than H04L), then redundant communication controllers: 11/20C2



- redundant storage controllers: 11/20S4
- No redundant connections: (no 11/20C4)

G06F 11/2005

{using redundant communication controllers}

Definition statement

This subgroup covers:

Communication controllers are nodes as defined under [G06F 11/2007](#) dedicated to performing communication control logic.

G06F 11/2007

{using redundant communication media}

Definition statement

This subgroup covers:

Interconnections are physical media and are of point-to-point type or of bus type. Two interconnections are only considered redundant if:

- they both physically connect the same nodes, wherein nodes are any components performing processing or control functionality (examples: computers, bridges, storage controllers, communication switches,

counter-example: physical repeater has neither processing nor control logic), and

- are configured to perform the same data transmissions.

Only documents fulfilling these criteria are classified here.

This group covers as well redundant dedicated interconnection media for I/O functionality as long as it does not use general purpose communication interconnection media (like LAN or USB cables).

G06F 11/201

{between storage system components}

Definition statement

This subgroup covers:

E.g. multiple IBM channels between controller and disk

G06F 11/2017

{where memory access, memory control or I/O control functionality is redundant (redundant communication control functionality [G06F 11/2005](#); redundant storage control functionality [G06F 11/2089](#))}

Definition statement

This subgroup covers:

All cases where memory access, memory control or I/O control functionality is redundant. An example would be redundant configurations having an active and a passive graphics adapter.

Special rules of classification within this group

Redundant dedicated interconnection media for such I/O functionality are to be classified in [G06F 11/2002](#) as long as it does not use general purpose communication interconnection media (like LAN or USB cables).

G06F 11/202

{where processing functionality is redundant (redundant communication control functionality [G06F 11/2005](#), redundant storage control functionality [G06F 11/2089](#))}

Definition statement

This subgroup covers:

All subject-matter where the redundancy resides in components that perform processing, i.e. components the runtime functionality of which is controlled

by software (or firmware), except for ones dedicated to storage control or communication control (see the precedence rule).

For subject-matter to be classified in this group, it is enough that a fault masking is tried when a failure occurs. It is not necessary to have a guarantee that resources will be available to successfully fail over.

Relationship between large subject matter areas

Two types of subgroups can be identified

- "architectural groups", i.e. groups that specify the actual redundancy arrangement (i.e. [G06F 11/2035](#)-[G06F 11/2048](#))
- "functional groups", i.e. groups that define a particular functionality (i.e. [G06F 11/2023](#), [G06F 11/2051](#)). This functionality is independent of the particular redundancy arrangement used.

Special rules of classification within this group

This group has 4 types of subgroups. A class in each of the types should be given (as far as disclosed in the document) systematically. Thus, a document classified in these subgroups will normally have 3 or 4 symbols (invention or additional). The four types are :

- [G06F 11/2023](#) and subgroups
- [G06F 11/2035](#) - [G06F 11/2041](#)
- [G06F 11/2043](#) - [G06F 11/2048](#)
- [G06F 11/2051](#)

G06F 11/2023

{details of failing over}

Definition statement

This subgroup covers:

Details of the failover mechanism

Also includes documents describing fallback, i.e. reverting to the original or replacement primary processing unit when it becomes operational again. Currently this also covers documents dealing with the determination/selection of the spare to be used for replacing the failing component. There is failover taking place as soon as any functionality of a processing component is taken over by another processing component, whatever the functionality is.

G06F 11/2025

{using centralised failover control functionality}

Definition statement

This subgroup covers:

Where a single component implements the control functionality for failover. This may be a distinct hardware module or software implemented on a single one of the redundant processing components.

G06F 11/2028

{eliminating a faulty processor or activating a spare}

Definition statement

This subgroup covers:

Documents describing how to ensure that a failing and formerly active processing component no longer participates in the system functionality. Similarly, documents describing how to activate a former standby processing component to replace the functionality of a failing one. Example: setting bits identifying a node as active in a configuration file.

Special rules of classification within this group

On the contrary, eliminating a backup unit that is not active (i.e. not within a failover process) is not [G06F 11/20](#) since this is not error correction using redundancy in hardware. This is most likely [G06F 11/0793](#).

"Eliminating a faulty processor" needs to be understood broadly. E.g. this includes as well :

- documents describing a complete reconfiguration of the system which results in eliminating not only the faulty processor, but also some functioning components if needed to come to a fault-free system and
- documents dealing with how to determine the fault-free system configuration which eliminates the minimum number of components.

G06F 11/203

{using migration}

Definition statement

This subgroup covers:

Transferring runtime context of processes, tasks, jobs, threads etc... from a failing processing component to a replacing one.

G06F 11/2033

{switching over of hardware resources}

Definition statement

This subgroup covers:

The process of placing resources (other than the redundant processing components) under control of a replacement processing unit instead of a failing one. Example: attaching a RAID or other I/O device to the spare.

G06F 11/2035

{without idle spare hardware}

Definition statement

This subgroup covers:

There are no processing components left inactive in failure-free operation.

This group contains all subject-matter where the performance is degraded after a failure has occurred, since the same processing needs to be done on less hardware.

However, performance degradation is not a necessary condition for this group, since a safety margin can be used in the failure-free operation.

Special rules of classification within this subclass/group

"Hot spare" architectures wherein the spares are maintained updated for immediate failover by performing the same processing as the primary (possibly in clock synchronisation with the latter) do not fall in this group, because such spares are considered inactive to the extent they do not perform system functionality beyond what is necessary to function as spare. The same applies to architectures where spares are not completely idle because they monitor the primary to detect whether it is failing. These examples would rather be classified in [G06F 11/2038](#) or [G06F 11/2041](#).

G06F 11/2038

{with a single idle spare processing component}

Definition statement

This subgroup covers:

The spare component can be spare for a single one or for a plurality of active processing components. There may be multiple spares which, however, are each a single spare for distinct sets of active processing components.

Also covers the case where the spare component is a hot spare.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Without idle spare hardware	G06F 11/2035
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G06F 11/2041

{with more than one spare processing components}

Definition statement

This subgroup covers:

A processing component has more than one spare.

Also covers the case where at least one spare component is a hot spare.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Without idle spare hardware	G06F 11/2035
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G06F 11/2043

{where the redundant components share a common memory address space}

Definition statement

This subgroup covers:

Examples: symmetric multiprocessor; multicomputer with virtual shared memory based on message passing.

G06F 11/2046

**{where the redundant components share persistent storage
([G06F 11/2043](#) takes precedence)}**

Definition statement

This subgroup covers:

Any architecture where redundant components have (at least temporarily) access to common storage independent of whether or not the shared storage is used for or during failover.

References relevant to classification in this group

This subgroup does not cover:

Where the redundant components share a common memory address space	G06F 11/2043
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G06F 11/2053

{where persistent mass storage functionality or persistent mass storage control functionality is redundant (error detection or correction in information storage based on relative movement between record carrier and transducer [G11B 20/18](#))}

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Storage	persistent memory subsystems (typically involving disks), the contents of which are not directly physically addressable as data words by a CPU
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G06F 11/2056

{by mirroring}

Definition statement

This subgroup covers:

All subject-matter related to mirroring.

Relationship between large subject matter areas

Mirroring means that data replication is performed solely by the storage controller(s) or corresponding drivers without the involvement of higher software layers like file systems or databases. However, information provided by such higher layers within the blocks dealt with by the controllers (like sequence numbers or time stamps) may be used within the mirroring operation.

If a higher software layer is involved, this is not considered as mirroring but as backup (if point-in-time) or replication (if continuous) and should be classified in the appropriate places.

Mirroring implies, that the time at which a piece of data is transferred is determined solely by the mirroring functionality (disk controller, disk driver, ...). In contrast, for backup a trigger is necessary from another (typically higher level) software layer.

As a counter-example (i.e. which is not mirroring, but something in [G06F 11/1402](#)):

- periodic creation of snapshots and transfer of delta between successive snapshots to update a secondary storage.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Arrangements for replication or mirroring the data, e.g. data synchronisation between network nodes and/or user terminals	H04L 29/0854
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G06F 11/2058

{using more than 2 mirrored copies}

Definition statement

This subgroup covers:

Each of the more than 2 copies is a mirrored copy, the original (primary) data itself also being considered as one mirrored copy. An intermediate volume used as a buffer but not representing a full copy (suitable for failover) would not be considered a mirrored copy.

Special rules of classification within this group

Subject-matter combining mirroring and backup should have double classification.

G06F 11/2064

{while ensuring consistency}

Definition statement

This subgroup covers:

This covers distinct types of consistency problems like write order consistency, consistency between different volumes (broken links problem), consistency groups or writes.

G06F 11/2066

{Optimisation of the communication load}

Definition statement

This subgroup covers:

Measures aiming at reducing the amount of data being transferred in the mirror system e.g. from the primary to the mirror site, or between the Host and the primary. Examples: "write coalescing", sending record logs instead of full blocks (journaling).

G06F 11/2079

{Bidirectional techniques}

Definition statement

This subgroup covers:

Systems in which updates occur independently on different mirror copies and are simultaneously propagated to the respective other mirror copies.

G06F 11/2082

{Data synchronisation}

Definition statement

This subgroup covers:

This covers resynchronisation of a failed or reconnected mirror as well as initial synchronisation to start mirroring.

Informative references

Attention is drawn to the following places, which may be of interest for search:

For non-mirroring related disk initialisation	G06F 11/1662
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G06F 11/2089

{Redundant storage control functionality}

Relationship between large subject matter areas

Mirroring with multiple controllers does not imply that the controllers are redundant. If one of the storage controllers would be faulty in such a system, either the host will not be able to access the storage anymore or the mirroring functionality will be lost. Thus some storage control functionality will be lost and there is no redundancy on this level.

G06F 11/2092

{Details of failing over between control units}

Definition statement

This subgroup covers:

This group contains the details about how the faulty storage control element is taken out of operation or how storage control functionality is transferred to other elements.

Examples are :

- changing the system configuration
- shut down of the controller concerned

Counter-example:

Eliminating a backup unit that is not active (i.e. not within a failover process) is not [G06F 11/20](#) since this is not error correction using redundancy in hardware. This is most likely [G06F 11/0793](#).

G06F 11/2094

{Redundant storage or storage space ([G06F 11/2056](#) takes precedence)}

Definition statement

This subgroup covers:

Architectures and problems involving the use of additional storage (space) intended to be used instead of failing storage (space). Typical problems involve eliminating a failing active storage unit or activating spares (possibly storing replicated data).

Also to be used when it is not clear whether an eliminated disk has its data replicated elsewhere.

Relationship between large subject matter areas

In the case of failing over, this group does not cover the data initialisation of an activated spare, because this is [G06F 11/1662](#).

Note that because of the precedence rule failover in the context of mirroring is not dealt with in this group (see [G06F 11/2069](#)).

G06F 11/2097

{maintaining the standby controller/processing unit updated (initialisation or re-synchronisation thereof [G06F 11/1658](#) and subgroups)}

Definition statement

This subgroup covers:

This group contains details of the measures that are taken to keep the data in memory, and/or persistent storage of a spare/stand-by unit (processor or controller) current in order to be ready for take-over. This is a repetitive process (frequently involving data replication) used before the occurrence of the fault.

This group does not contain details of how a component's data is initially made ready to function as backup (this belongs to [G06F 11/1658+](#)).

Examples for the use of this group:

- replaying message log on standby node: transmission of log (before failure) is [G06F 11/2097](#), replaying of log is failover ([G06F 11/2023](#)) if performed after the failure.
- very hot standby using running standby in lockstep without comparison. The lockstep aspect is to be classified in [G06F 11/1675](#) (Indexing Code or EC according to importance). However, since it addresses the problem of maintaining the standby unit updated [G06F 11/2097](#) (possibly Indexing Code) should be given.

Example: Two redundant disk controllers control a single disk. Host write requests received by one controller are transferred to the second one (including the data) for temporary buffering until the write is performed by the first one. Should the first one crash, the second one is able to perform incomplete writes. Hence, the second one is maintained updated by the first one for potential failover.

Special rules of classification within this group

A symbol to indicate the type of redundancy in Hardware (e.g. [G06F 11/2038](#)) must be added as additional, when the type of redundancy is not otherwise classified.

G06F 11/22

Detection or location of defective computer hardware by testing during standby operation or during idle time, e.g. start-up testing (testing of digital circuits, e.g. of separate computer components [G01R 31/317](#))

Definition statement

This subgroup covers:

This group and its subgroups also cover testing at system level, i.e. testing of a combination of hardware and software.

This testing occurs at a time outside of "normal operating mode", e.g. during standby, idle time or at power on.

Next to the testing per se, this group and its subgroups also cover the equipment which is used to test the hardware concerned or to interpret the test results.

Relationship between large subject matter areas

Subject-matter is classified here if programmable processing logic is part of the device under test. Else, the subject-matter belongs to [G01R 31/317](#).

References relevant to classification in this group

This subgroup does not cover:

Testing of digital circuits	G01R 31/317
Testing of computer memories	G11C 29/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Testing of Software	G06F 11/36
Verification of a hardware design	G06F 17/50

Special rules of classification within this group

General rules for [G06F 11/22](#) and subgroups

In [G06F 11/22](#) and subgroups, generally only 1 symbol is allocated. The symbol allocated is the most relevant one for the invention information disclosed.

Only if the component being tested and the test itself are important, should the subject-matter be classified in one of the subgroups [G06F 11/2205](#) together with another group in [G06F 11/22](#).

Only invention information is classified.

If the software testing part is described and is important, the document should also be sent to [G06F 11/36](#) for classification.

Rules specific to [G06F 11/22](#) per se:

Documents are only classified in [G06F 11/22](#) per se if it can not be established whether the test is marginal checking (classified in [G06F 11/24](#)), testing of logical operation (classified in [G06F 11/25](#)) or functional testing (classified in [G06F 11/26](#)).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Computer hardware	a digital circuit which has programmable processing logic incorporated.
Testing	an execution of the computer hardware which is dedicated to the detection of faults. Thus, the execution of the hardware during the test is not part of the "useful" processing which contributes to achievement of the intended purpose

G06F 11/2247

{Verification or detection of system hardware configuration}

Special rules of classification within this group

Group no longer used for classification. See [G06F 11/2289](#) instead.

G06F 11/2252

{using fault dictionaries}

Definition statement

This subgroup covers:

Subject-matter where the testing process or test analysis process is guided by a fault dictionary. This is the case when a lookup (based on the test results) is done directly from a list of entries, without any additional processing.

Although 90% of the documents use the fault dictionary to determine where the fault is located or what actions to take; the group also covers subject-matter where information is looked up in the fault dictionary to determine the next test.

G06F 11/2257

{using expert systems}

Definition statement

This subgroup covers:

Subject-matter where an error message is correlated with other error messages or parameters.

Although 90% of the documents use expert systems to determine where the fault is located or what actions to take; the group also covers subject-matter where the expert system is used to determine the next test.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Expert system	A computer program that contains a knowledge base and a set of algorithms or rules that infer new facts from knowledge and from incoming data.
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G06F 11/2263

{using neural networks}

Definition statement

This subgroup covers:

Although 90% of the documents use the neural network to determine where the fault is located or what actions to take; the group also covers subject-matter where the neural network is used to determine the next test.

G06F 11/2273

{Test methods}

Definition statement

This subgroup covers:

Subject-matter where the focus is on how the test is done instead of on what test is done or what is tested.

In general, the documents classified in this subgroup are of a more theoretical nature.

G06F 11/2284

{by power-on test, e.g. power-on self test [POST]}

Definition statement

This subgroup covers:

Subject-matter describing what tests are being done on power on. The tests concern the correct functioning of the system as a whole.

Relationship between large subject matter areas

Documents describing the execution of tests are classified in [G06F 11/26](#) and subgroups.

G06F 11/2289

{by configuration test}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Detection of the configuration of a system	G06F 8/71
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G06F 11/25

Testing of logic operation, e.g. by logic analysers

Definition statement

This subgroup covers:

All testing where the level of the logical value (e.g. 0 or 1) of the signal is tested, independent of functionality.

G06F 11/261

{by simulating additional hardware, e.g. fault simulation}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Debugging using additional hardware	G06F 11/3648
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G06F 11/263

Generation of test inputs, e.g. test vectors, patterns or sequences; {with adaptation of the tested hardware for testability with external testers}

Definition statement

This subgroup covers:

Subject-matter concerning the generation of test inputs, where this generation is done externally to the system being tested. It covers as well arrangements where both test input generation and test result processing are done externally to the system being tested.

G06F 11/267

Reconfiguring circuits for testing, e.g. LSSD, partitioning

Definition statement

This subgroup covers:

All adaptations to the hardware being tested to make the hardware more testable.

G06F 11/27

Built-in tests

Definition statement

This subgroup covers:

Those tests which are incorporated in the hardware component itself which is being tested.

G06F 11/273

Tester hardware, i.e. output processing circuits {([G06F 11/263](#) takes precedence)}

References relevant to classification in this subclass/group

This subgroup does not cover:

[G06F 11/263](#) takes precedence.

G06F 11/277

with comparison between actual response and known fault-free response

Special rules of classification within this group

Group no longer used for classification.

G06F 11/28

by checking the correct order of processing ([G06F 11/08](#) - [G06F 11/26](#) take precedence; monitoring patterns of pulse trains [H03K 5/19](#))

Definition statement

This subgroup covers:

Checking the correct order of processing. the word "order" implies the consideration of a sequence. It can be for example the sequence of instructions in a computer program, the sequence of steps to perform when installing a software on a computer, etc. Typically documents dealing with the verification of a system that is specified in terms of state machine (states and transitions between states) based on reachability analysis can be found in the group. Also documents dealing with the verification that a computer program is executing according to the expected sequence of instructions (i.e. there is no unexpected jump that could be the result of a malicious attack) can be found in the group. This can be done for example by computing a current signature while the program is executing and comparing it to a reference signature.

References relevant to classification in this group

This subgroup does not cover:

Checking the correct execution order of instructions for security purposes	G06F 21/00
Monitoring patterns of pulse trains	H03K 5/19

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

FSM, FSA	A finite state machine (FSM) or finite state automata (FSA) is a mathematical abstraction sometimes used to design digital logic or computer programs. It is a behaviour model composed of states and transitions between the states.
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Signature	A signature is a value resulting from the application of a function to some computer data, for example a hash function.
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Synonyms and Keywords

In patent documents the following abbreviations /words "sequence", "FSM (Finite State Machine)" or "FSA (Finite State Automata)" are often used as synonyms.

G06F 11/30

Monitoring

Definition statement

This subgroup covers:

Monitoring refers to an extra functionality for observing properties of a running computing system in its normal operating conditions without inputting test data.

References relevant to classification in this group

This subgroup does not cover:

Monitoring of control systems	G05B 23/02
Thermal management in cooling means	G06F 1/206
Power management	G06F 1/3203
Monitoring for error detection	G06F 11/0751
Verification or detection of system hardware configuration	G06F 11/2002
Monitoring intrusion in a computer system	G06F 21/566
Network monitoring	H04L 12/2602
Network security. Monitoring network traffic	H04L 29/06877
Monitoring testing in wireless networks	H04W 24/00

Special rules of classification within this group

The classification process in the [G06F 11/30](#) and its subgroups has to be carried out performing the following steps:

- 1. If the document contains interesting aspects about the observation of properties of a running computing system over time in its normal operating conditions without inputting test data, then proceed with ALL of the following steps 2, 3, 4.1, 4.2, 4.3, 4.3.1, 4.4, 4.5 and 5

in sequence, otherwise stop because the document is not to be understood to be about monitoring;

- 2. If the document contains interesting aspects about the (visual or acoustical) display of the monitored data, then classify the document in [G06F 11/32](#) and its subgroups;
- 3. If the document contains interesting aspects about the monitoring of computer activity, then classify the document according to the FCRs of [G06F 11/34](#) and subgroups;
- 4.1. If the document contains interesting aspects about monitoring the configuration of the computing system, then classify the document in [G06F 11/3051](#);
- 4.2. If the document contains interesting aspects about monitoring the status of the computing system, then classify the document in [G06F 11/3055](#);
- 4.3. If the document contains interesting aspects about the monitoring of environmental parameters of the computing system, then classify the document in [G06F 11/3058](#) and subgroups;
- 4.3.1. If power consumption is evaluated through the monitoring of computer activity, then also classify the document in [G06F 11/34](#) and subgroups according to the FCRs of [G06F 11/34](#);
- 4.4. If the document contains interesting aspects about the reporting of the monitored data, then classify the document in [G06F 11/3065](#) and its subgroups;
- 4.5. If the document contains interesting aspects about the sensing of the monitored data, then classify the document in [G06F 11/3089](#) and its subgroups;
- 4.6. If the document has been classified at least once in [G06F 11/3051](#), [G06F 11/3055](#), [G06F 11/3058](#), [G06F 11/3065](#), [G06F 11/3089](#) or their subgroups, then classify the document in [G06F 11/3003](#) and its subgroups;
- 5. If none of the steps 2-4.6 apply, then classify the document in [G06F 11/30](#).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Computer activity	For this group and its subgroups, computer activity covers the activities performed by the computer system that involve data (e.g. processing, data storage, data transfer). It also includes user activity.
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Monitoring system	A monitoring system is generally considered to be composed of observing or measuring entities (usually called monitors or observers) and interfaces/probes which link them to the system under observation.
Interfaces/probes	The interfaces/probes sense (or access) data relative to the system under observation and report them to the observing/measuring entities.
Probe effect	The probe effect is the undesired alteration of a system property caused by the fact that this property is being observed or measured.
Environmental parameters	Environmental parameters of a computing system are: power, currents, temperature, humidity, position, radiation, etc.

G06F 11/34

Recording or statistical evaluation of computer activity, e.g. of down time, of input/output operation; {Recording or statistical evaluation of user activity, e.g. usability assessment}

Definition statement

This subgroup covers:

For this group and its subgroups, computer activity covers the activities performed by the computer system that involve data (e.g. processing, data storage, data transfer). It also includes user activity.

This group also includes the modeling of the system or its behaviour, or simulating the execution of the system for observing its properties on a theoretical level.

Special rules of classification within this group

As criterion to decide whether [G06F 11/34](#) and subgroups applies, it needs to be considered whether computer activity or user activity is being monitored or not.

If the monitoring is done purely to detect when an error occurs, [G06F 11/0703](#) and subgroups apply instead of [G06F 11/34](#) and subgroups.

Recording data during software testing or debugging is classified in [G06F 11/36](#) and subgroups.

The subgroups of [G06F 11/34](#) fall apart in 2 blocks :

- [G06F 11/3404](#) - [G06F 11/3442](#) and subgroups deal with what is being monitored.
- [G06F 11/3447](#) - [G06F 11/3466](#) and subgroups deal with how the monitoring is done.

If both aspects are relevant, classes should be given in both ranges. E.g. performance measurement ([G06F 11/3409](#) or subgroups) where a particular monitoring hardware is used to perform the measurement ([G06F 11/3466](#) or subgroups) is classified in both ranges.

Documents where the monitoring relates to the monitoring of user actions must be systematically classified in [G06F 11/3438](#) (as invention or additional information), independent of any other classification.

Following Indexing Codes must be systematically given for documents classified in [G06F 11/34](#) and subgroups :

- [G06F 2201/80](#) if the monitoring is specific to databases
- [G06F 2201/81](#) if a threshold influences the monitoring behaviour
- [G06F 2201/815](#) if the monitoring concerns the effects of virtualisation
- [G06F 2201/86](#) for all event-based monitoring
- [G06F 2201/865](#) if software is being monitored
- [G06F 2201/87](#) if the monitored object is a transaction
- [G06F 2201/875](#) if the monitored system includes the internet
- [G06F 2201/88](#) if counts are used
- [G06F 2201/885](#) if the monitored object includes a cache

If the document does not describe what is being monitored, its subject-matter should not be classified in [G06F 11/34](#), but in [G06F 11/30](#) or other subgroups of [G06F 11/30](#).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Monitoring	Extra functionality for observing properties of a running computing system over time in its normal operating conditions without inputting test data
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G06F 11/3404

{for parallel or distributed programming}

Definition statement

This subgroup covers:

The subject-matter of this group covers monitoring of parallel or distributed programming. Typical issues addressed are : determining the degree of parallelism, optimizing the degree of parallelism, performance of distribution algorithms.

G06F 11/3409

{for performance assessment}

Definition statement

This subgroup covers:

monitoring the performance of the computer system or its components.

This group covers not only the monitoring of time, but usage of any (physical or other) resource as well.

This group applies whatever the component (e.g. disk, processor, scheduler,...) of which the performance is being monitored is.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Monitoring of user actions	G06F 11/3438
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G06F 11/3433

{for load management (allocation of a server based on load conditions [G06F 9/505](#); load rebalancing [G06F 9/5083](#); redistributing the load in a network by a load balancer [H04L 67/1029](#))}

Definition statement

This subgroup covers:

Only the monitoring activities to determine the load of a computer system or the distribution of the load on the different components of the computer system. However it does not cover any actions that are performed in response to the determined load.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Adapting or redistributing the load in a computer system	G06F 9/00
Adapting or planning the capacity required	G06F 11/3442
Redistributing the load in a network by a load balancer	H04L 67/1029

Special rules of classification within this group

If time measurement is used to be able to determine the load, documents should be classified as well in [G06F 11/3419](#).

G06F 11/3438

{monitoring of user actions (checking the network activity of the user for network-specific applications [H04L 67/22](#))}

Definition statement

This subgroup covers:

all documents where actions of the user are monitored (e.g. for productivity or allocation of billable employee time).

This includes arrangements to evaluate the usability of a system or component.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Checking the network activity of the user for network-specific applications	H04L 67/22
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Usability	Measure of the ease of use of a specific object or set of objects or of how easy the object or set of objects is to learn to use
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G06F 11/3442

{for planning or managing the needed capacity}

Definition statement

This subgroup covers:

This group covers all subject-matter where monitoring is done to come to conclusions about the capacity required. It is necessary that this goal is explicit in the document.

Capacity should be understood here as relating to how much computer resources are needed. In general these are hardware resources (such as the amount of processing power, memory or storage space). However this can also be software resources emulating such hardware (such as an amount of virtual memory, a number of virtual machines, etc.).

In contrast to [G06F 11/3433](#), here the load is taken as a given and the goal is to come to conclusions about the resources that need to be available. The actions taken in response will change the configuration of the system.

Relationship between large subject matter areas

The actions per se performed to adapt the capacity are not classified here, but rather in [G06F 9/00](#).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Measures to allocate resources	G06F 9/00
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G06F 11/3447

{Performance evaluation by modeling}

Definition statement

This subgroup covers:

This group deals with subject-matter where a model of the system to be monitored (or part of it) is made or modified. This group does not cover the use of the model as monitoring tool (which should be classified according to what is being monitored).

E.g. :

- This group covers the construction of a model to determine monitoring points in the system. However, it does not cover a

concrete implementation of the monitoring points (which would be in [G06F 11/3466](#)).

- This group covers the construction of a model to be used in a simulation. However, the use of the model in a simulation is not covered (this would be in [G06F 11/3457](#)).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Model	description of a system using mathematical concepts and language. It may help to explain a system and to study the effects of different components or parameters, and to make predictions about system behaviour
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G06F 11/3452

{Performance evaluation by statistical analysis}

Definition statement

This subgroup covers:

Performance evaluation by statistical analysis means that statistics are used to come to a conclusion regarding a system parameter. This may be to evaluate system parameters or predict the future behaviour of the system.

It covers as well subject-matter where a relation between different parameter is modelled, based on measured values documenting the relationship (e.g. curve-fitting)

Typically, this would involve multiple executions or the analysis of time series observed.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Stochastic model development of the system for monitoring	G06F 11/3447
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G06F 11/3457

{Performance evaluation by simulation}

Definition statement

This subgroup covers:

Simulation means that execution characteristics of the system or component to be monitored are observed without actually executing the real system or without executing the system or component under real conditions.

Examples are:

- Monitoring the execution of the real system but with a fictive workload
- Applying a real workload to a model or a mockup of the system

G06F 11/3466

{Performance evaluation by tracing or monitoring}

Definition statement

This subgroup covers:

The title of this groups should be read as "by tracing". This group and its subgroups are also relevant if the tracing is not explicitly done to evaluate the performance (for instance if no specific purpose is stated for the tracing).

This group covers arrangements that describe how monitored data of the physical system is being collected or made available. These arrangements can be internal in the system (i.e. tracing) or external to the system (general monitoring arrangements used for monitoring computer activity).

Relationship between large subject matter areas

Tracing for software testing or debugging purposes is classified in [G06F 11/36](#) and subgroups.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Tracing	Observing or making available monitored data using additional hardware or software functionality in the monitored system or component
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G06F 11/3471

{Address tracing}

Definition statement

This subgroup covers:

Examples are:

- Observing the addresses circulating on a computer bus
- Monitoring memory accesses for certain address ranges

G06F 11/3476

{Data logging ([G06F 11/14](#), [G06F 11/2205](#) take precedence)}

Definition statement

This subgroup covers:

The scope of this group is not restricted to logging of monitoring data per se. It covers as well the determination of what monitoring data should be logged and how it should be logged (e.g. condensing the logged data, logging statistics, ...) and analysis of logged monitoring data.

G06F 11/3485

{for I/O devices}

Special rules of classification within this group

Documents describing the monitoring of channels should additionally be classified in [G06F 11/349](#).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Channel	An independent hardware component that coordinates all I/O to a set of controllers or devices
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G06F 11/349

{for interfaces, buses}

Special rules of classification within this group

Documents describing the monitoring of channels should additionally be classified in [G06F 11/3485](#).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Channel	An independent hardware component that coordinates all I/O to a set of controllers or devices
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G06F 11/3495

{for systems}

Definition statement

This subgroup covers:

Applies when communication or interaction between the processing components influences the assessed properties of the whole system.

Thus, it is a necessary condition to have a communication medium involved, however not a sufficient condition. If the system which is observed is limited to the communication medium, it should not be classified here (but in [H04L](#) if the medium is a network or in [G06F 11/349](#) if the medium is a bus).

Examples are:

- Monitoring arrangements for distributed systems
- Arrangements for application level response time measurement of web servers
- Monitoring arrangements in a multiprocessor system

Relationship between large subject matter areas

If the communication protocol or the hardware characteristics of the network are relevant for the monitoring, this should be (additionally) classified in [H04L](#).

G06F 11/36

Preventing errors by testing or debugging software

Definition statement

This subgroup covers:

The methods used during software development in order to prevent errors:

- software Analysis ([G06F 11/3604](#) and subgroups), which refers to verifying properties of a program (statically or dynamically)
- software testing ([G06F 11/3668](#) and subgroups), which refers to the activity of detecting errors (using test inputs)
- software debugging ([G06F 11/362](#) and subgroups), which refers to the activity of locating an error.

The class also covers the environments (e.g. GUI, simulators) helping a user to perform software debugging or testing ([G06F 11/3664](#)).

Relationship between large subject matter areas

Tracing for performing performance analysis; [G06F 11/3466](#)

Emulators and simulators used for testing computer hardware; [G06F 11/261](#)

User interface programs; [G06F 9/4443](#)

Generating or modifying source code; [G06F 8/30](#)

CASE, software engineering tools; [G06F 8/30](#)

Compiling; **G06F9/45**

Concurrent instruction execution; [G06F 9/38](#)

References relevant to classification in this group

This subgroup does not cover:

Hardware testing	G06F 11/22
Performance evaluation	G06F 11/34
Fault-tolerant software	G06F 11/1479
Checking correct execution order of instructions	G06F 11/28
Patching of programs	G06F 9/328
Byte-code verification	G06F 9/44589
Computer aided design using simulation, modelling	G06F 17/50
Security checking or analysis	G06F 21/00

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Bug	A bug in a program produces an incorrect or unexpected result, or causes the program to behave in unintended ways.
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Software analysis	Software Analysis aims at verifying that a program or its specification satisfies certain properties without involving testing (no test inputs are provided to the program under analysis). It can involve for example scanning the source code and analysing the dependencies between the various components, or the use of certain variables, etc. It can consist in the use of formal methods, like model checking or theorem proving which aim at formally guaranteeing certain properties, for example that the program is well-typed, or deadlock free etc. In principle Software analysis does not require the program to execute (static analysis), but in some cases it does, for example to verify runtime properties.
Software testing	Software testing is the process of executing a program, or a discrete program unit, with the intent of finding errors. Tests can only reveal the presence of errors, but cannot ensure the absence of errors. When errors are detected in a program, one might want to start debugging it, i.e. locating precisely the error and correcting it. In both cases (testing and debugging), the program is executed.
Software debugging	Software debugging refers to the activity of locating an error.

G06F 11/3604

{Software analysis for verifying properties of programs (byte-code verification [G06F 9/44589](#))}

Definition statement

This subgroup covers:

Software Analysis aims at verifying that a program or its specification satisfies certain properties without involving testing (no test inputs are provided to the program under analysis). It can involve for example scanning the source code and analysing the dependencies between the various components, or the use of certain variables, etc. It can consist in the use of formal methods, like model checking or theorem proving which aim at formally guaranteeing certain properties, for example that the program is well-typed, or deadlock free etc. In principle Software analysis does not require the program to execute (static analysis), but in some cases it does, for example to verify runtime properties.

G06F 11/3608

{using formal methods, e.g. model checking, abstract interpretation (theorem proving [G06N 5/006](#))}

Definition statement

This subgroup covers:

Mathematically-based techniques (model checking, abstract interpretation, formal proof) for the verification of a program.

G06F 11/3612

{by runtime analysis (performance monitoring [G06F 11/3466](#))}

Definition statement

This subgroup covers:

Analysing runtime behaviour to detect errors (e.g. performance bug or infinite loops).

G06F 11/3616

{using software metrics}

Definition statement

This subgroup covers:

A software metric is a measure of some property of a piece of software or its specifications, e.g. number of lines in the code, cyclomatic complexity (number of linearly independent paths through a program's source code), or any measure which aims at evaluating the properties of a program.

References relevant to classification in this group

This subgroup does not cover:

Software metrics used during software generation	G06F 8/77
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G06F 11/362

{Software debugging}

Definition statement

This subgroup covers:

Software debugging is the activity of locating and correcting an error.

References relevant to classification in this group

This subgroup does not cover:

Patching of programs	G06F 9/328
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G06F 11/3624

{by performing operations on the source code, e.g. via a compiler}

Definition statement

This subgroup covers:

Manual or compiler assisted instrumentation or by any automatic tool of the source code according to an instrumentation policy.

G06F 11/3628

{of optimised code (optimisation [G06F 8/443](#))}

Definition statement

This subgroup covers:

Usually the debugging process is performed on an un-optimised version of a program, and the program is optimised (by the compiler) when fully debugged. However, in some cases one wants to debug the optimised version of a program: for example, some bugs might occur in the optimised version of the code only. An obvious problem that an optimised code will create is when a developer sets a breakpoint in a part of code that has been eliminated by the compiler during optimisation.

G06F 11/3632

{of specific synchronisation aspects}

Definition statement

This subgroup covers:

- Methods and arrangements for dealing with the synchronisation issues involved with debugging operations (e.g. when inserting a breakpoint in a multithreaded or distributed program).
- Method and arrangements for investigating synchronisation problems in distributed or multithreaded programs.

G06F 11/3636**{by tracing the execution of the program}****Definition statement***This subgroup covers:*

Methods and arrangements for generating or analysing traces of a program execution.

G06F 11/364**{tracing values on a bus}****Definition statement***This subgroup covers:*

Methods and arrangements for gathering or analysing data exchanged on a computer bus (e.g. data bus, memory bus) during the execution of a program.

G06F 11/3644**{by instrumenting at runtime}****Definition statement***This subgroup covers:*

- Instrumenting operations performed on a compiled program directly before execution (e.g. Valgrind).
- Runtime injection: the code is modified at runtime.

References relevant to classification in this group*This subgroup does not cover:*

Instrumentation of Bytecodes	G06F 11/3624
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G06F 11/3648**{using additional hardware}****Definition statement***This subgroup covers:*

Hardware arrangements contributing to the debugging process

G06F 11/3652

{in-circuit-emulation [ICE] arrangements}

Definition statement

This subgroup covers:

The term "In-Circuit Emulator" in this group only refers to a device replacing the target microprocessor. The code under debug is not executed on the real target processor but rather on a specific hardware that emulates the target processor and that comprises debug facilities for setting breakpoints or watchpoints.

Special rules of classification within this group

Nowadays, the term "In-Circuit Emulator" refers also to a JTAG or BDM based device which provides access to the internal registers of the target microprocessor. Said device can take control of the target microprocessor, start, stop or resume the code execution. The code under debug is executed on the real target microprocessor, in that case. If the technical contribution of a document refers to such a JTAG/BDM based device, this document should be classified in [G06F 11/3656](#) group (Debug interfaces).

G06F 11/3656

{using a specific debug interface}

Definition statement

This subgroup covers:

Aspects related to communication between a host and a target (e.g. JTAG/BDM based "In-Circuit Emulator").

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

JTAG	Joint Test Action Group (JTAG) is the common name for what was later standardized as the IEEE 1149.1 Standard Test Access Port and Boundary-Scan Architecture. JTAG refers nowadays to a bus for transferring debug commands from a host to a target and debug data from the target to the host.
BDM	Background Debug Mode (BDM) interface is an electronic interface that allows debugging of embedded systems. BDM interface allows a Host to manage and query a target.

G06F 11/366

{using diagnostics ([G06F 11/0703](#) takes precedence)}

Definition statement

This subgroup covers:

The aim of this group is to be able for example, to classify documents which have to do with software bugs, but not at the software development phase, afterwards. For example, if a system crashes during operation, it might be caused by a software bug. The system is diagnosed after the crash (or the failure) to find out where the bug was. This group might have overlap with the **G06F11/07P** and subgroups... e.g. analysis of core dumps, post-mortem debugging, memory leaks, and failure analysis.

G06F 11/3664

{Environments for testing or debugging software}

Definition statement

This subgroup covers:

Environment, frameworks, Graphical User Interfaces or simulators that aim at supporting or facilitating the task of a user during the various phases of software testing or software debugging (e.g. to navigate into the code, to or remove breakpoints, to visualize execution traces, to edit/maintain/archive test suites).

The environment may be comparable to a Software Development Environment but it contains features that are specific to the phases of software testing or debugging.

G06F 11/3668

{Software testing (software testing in telephone exchanges [H04M 3/242](#), testing of hardware [G06F 11/22](#))}

Definition statement

This subgroup covers:

Software testing is the process of executing a program, or a discrete program unit, with the intent of finding errors.

References relevant to classification in this subclass/group

This subgroup does not cover:

Software testing in telephone exchanges	H04M 3/242
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Testing of hardware	G06F 11/22
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G06F 11/3672

{Test management}

Definition statement

This subgroup covers:

The different activities of software testing:

- test case/script/scenario design ([G06F 11/3684](#))
- test coverage analysis ([G06F 11/3676](#))
- execution of the test cases/scripts/scenarii ([G06F 11/3688](#))
- analysis of the test results ([G06F 11/3692](#))
- maintenance and updates of the test cases/scripts/scenarii in parallel to the software evolution during software development ([G06F 11/368](#))

Special rules of classification within this group

The document should be classified according to the most relevant information concerning one activity of the software testing.

- if it is possible to identify one relevant piece of information related to one of the identified software testing activities, the document should be in classified in one of the corresponding subgroups: [G06F 11/3676](#), [G06F 11/368](#), [G06F 11/3684](#), [G06F 11/3688](#), [G06F 11/3692](#).
- If it is not possible to extract any relevant information concerning any of the identified software testing activities, the document should be classified in the test management subgroup ([G06F 11/3672](#))

G06F 11/3676

{for coverage analysis}

Definition statement

This subgroup covers:

Coverage analysis is concerned with the degree to which test cases exercise or cover the logic of the program. Because testing is a time consuming activity that cannot be exhaustive, the key issue is to apply a subset of all possible test cases which has the highest probability of detecting errors. Coverage analysis is therefore an issue at the design stage (strategy for generating test inputs that are effective in terms of coverage) as well as at the execution stage (how to measure coverage).

Test coverage can refer to different aspects:

- path coverage
- data coverage
- line coverage

G06F 11/368

{for test version control, e.g. updating test cases to a new software version}

Definition statement

This subgroup covers:

Maintenance and updates of test scripts in parallel to the evolution of the software during software development.

References relevant to classification in this group

This subgroup does not cover:

Version control; configuration management for creation of software	G06F 8/71
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G06F 11/3684

{for test design, e.g. generating new test cases}

Definition statement

This subgroup covers:

Generation or updates of test cases, scenarios, scripts. Specific languages for writing tests.

G06F 11/3688

{for test execution, e.g. scheduling of test suites}

Definition statement

This subgroup covers:

Scheduling of the tests; recording of test results; regression testing; mutation testing.

G06F 11/3692

{for test results analysis}

Definition statement

This subgroup covers:

Comparing the results of the tests with an oracle (assertions, mathematical models, simulations and the like).

G06F 11/3696

{Methods or tools to render software testable}

Definition statement

This subgroup covers:

Arrangements for facilitating the testing of a software unit:

- Arrangement can be an interface to provide test inputs.
- Arrangement for simulating missing part of software or hardware that are necessary for performing the execution and the testing of the software unit.
- Arrangement for performing a time compression in order to simulate a long term execution of a software program in a short time frame
- Arrangement for performing the test execution on a different platform

G06F 12/00

Accessing, addressing or allocating within memory systems or architectures ({digital input or output to record carriers, e.g. to disc storage units [G06F 3/06](#)}; information storage in general [G11](#))

References relevant to classification in this group

This group does not cover:

Accessing, addressing or allocation of record carriers, e.g. disk storage	G06F 3/06
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Memory management specially adapted to image processing	G06T 1/60
Static stores	G11C

Special rules of classification within this group

Any classification rules applicable to a specific group also apply to any sub-groups thereof unless overruled by more specific rules.

When one or more sub-group definitions are listed in the definition statement of a group no further description of these sub-groups are provided in this FCR.

The group [G06F 12/00](#) contains no material and should not be used for classification.

Use of Indexing Codes:

All ECLA classes have corresponding [G06F 12/00](#) Indexing Code-codes, which should be used for secondary aspects (non-invention information).

Indexing Scheme [G06F 2212/00](#):

In November 2011 a new indexing scheme relating to [G06F 12/00](#) has been introduced. The Indexing Codes from the range [G06F 2212/20](#)-[G06F 2212/7211](#) are mandatory when applicable. The code range [G06F 2212/10](#)-[G06F 2212/178](#) is not mandatory but should preferably be used for documents characterized by specific technical effects or applications.

Warning: The [G06F 2212/00](#) indexing scheme is new and has not yet been systematically applied to the existing documentation except when explicitly indicated in this document.

G06F 12/02

Addressing or allocation; Relocation (programme address sequencing [G06F 9/00](#); arrangements for selecting an address in a digital store [G11C 8/00](#))

References relevant to classification in this group

This subgroup does not cover:

Program address sequencing.	G06F 9/00
Low-level arrangements for selecting an address in a memory device.	G11C 8/00

Special rules of classification within this group

[G06F 12/02](#) should be used only for material not provided for in any of the sub-groups.

G06F 12/0207**{with multidimensional access, e.g. row/column, matrix}****Definition statement***This subgroup covers:*

Addressing or accessing memory in two or more dimensions, e.g. for transposing of data.

Addressing of rectangular blocks of data.

References relevant to classification in this group*This subgroup does not cover:*

Memory systems specially adapted to graphics processing or display.	G06T , G09G
Memory systems specially adapted to video processing.	H04N

G06F 12/0215**{with look ahead addressing means}****Definition statement***This subgroup covers:*

Page mode addressing of DRAM.

Speculative addressing of a memory in general.

References relevant to classification in this group*This subgroup does not cover:*

Prefetching to cache memory or use of dedicated prefetch buffers	G06F 12/0862
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Informative references*Attention is drawn to the following places, which may be of interest for search:*

Memory controllers	G06F 13/16
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G06F 12/0223

{User address space allocation, e.g. contiguous or non contiguous base addressing}

References relevant to classification in this group

This subgroup does not cover:

Module addressing	G06F 12/06
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Resource allocation	G06F 9/50
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G06F 12/023

{Free address space management}

Definition statement

This subgroup covers:

Dynamic memory allocation.

Explicit memory de-allocation.

Free space management.

G06F 12/0238

{in non-volatile memory}

Definition statement

This subgroup covers:

Memory management in non-volatile memory that is not specific to flash memory, e.g. in emerging memory types such as resistive RAM or ferroelectric memory.

G06F 12/0246

{in block erasable memory, e.g. flash memory}

Definition statement

This subgroup covers:

Addressing of flash memory, e.g. logical to physical address mapping;

Allocation within flash memory;

Management, e.g. cleaning, compacting, erasing;

Temporary storage of data, e.g. within volatile buffers or in buffer blocks.

References relevant to classification in this group

This subgroup does not cover:

Input/output arrangements for solid-state devices	G06F 3/0679
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Write caching	G06F 12/0804 , G06F 12/0866
Non-volatile memories	G11C 16/00

Special rules of classification within this group

Indexing Codes [G06F 2212/7201](#)- [G06F 2212/7211](#) are used in this group.
The coding of the existing documentation is mostly complete.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Page	The smallest data unit of read or write access in a NAND flash memory.
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G06F 12/0253

{Garbage collection, i.e. reclamation of unreferenced memory}

Definition statement

This subgroup covers:

Automatic reclamation of heap-allocated memory after last use by a program, i.e. where the allocated memory is not explicitly freed by the program.

References relevant to classification in this group

This subgroup does not cover:

Explicit freeing of memory	G06F 12/023
Compaction and cleaning within flash memory	G06F 12/0246

Special rules of classification within this group

The Indexing Code [G06F 2212/702](#) should be used for conservative garbage collection. The coding of the existing documentation is mostly complete.

G06F 12/0284

{Multiple user address space allocation, e.g. using different base addresses (interprocessor communication [G06F 15/163](#))}

Definition statement

This subgroup covers:

Multi-user or multiprocessor address space allocation.

Mapping arrangements therefore, e.g. local to global address space mapping.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Virtual address translation	G06F 12/10
Interprocessor communication	G06F 15/163

G06F 12/0292

{using tables or multilevel address translation means ([G06F 12/023](#) takes precedence; address translation in virtual memory systems [G06F 12/10](#))}

References relevant to classification in this group

This subgroup does not cover:

Free address space management	G06F 12/023
Multiple user address space allocation	G06F 12/0284
Virtual memory address translation.	G06F 12/10

G06F 12/04

Addressing variable-length words or parts of words

Definition statement

This subgroup covers:

Addressing variable length words.

Addressing parts of a word, e.g. bit fields.

Addressing unaligned words.

References relevant to classification in this group

This subgroup does not cover:

Address generation within processors	G06F 9/34
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Information transfer on a bus	G06F 13/38
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G06F 12/06

Addressing a physical block of locations, e.g. base addressing, module addressing, memory dedication ([G06F 12/08](#) takes precedence)

Definition statement

This subgroup covers:

Addressing or allocation of physical memory modules or banks.

Module selection, e.g. using chip selects.

References relevant to classification in this group

This subgroup does not cover:

Addressing or allocation within a memory module.	G06F 12/0223
Hierarchical memory arrangements	G06F 12/08

Informative references

Attention is drawn to the following places, which may be of interest for search:

Memory controller.	G06F 13/16
Bank or array addressing within individual memory devices.	G11C 8/00 , G11C 11/00

G06F 12/08

in hierarchically structured memory systems, e.g. virtual memory systems

Definition statement

This subgroup covers:

Hierarchical memory systems.

Virtual memory.

Paging.

References relevant to classification in this group

This subgroup does not cover:

Hierarchically organised storage systems	G06F 3/06
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Virtual address translation	G06F 12/10
Replacement control	G06F 12/12

G06F 12/0802

{Addressing of a memory level in which the access to the desired data or data block requires associative addressing means, e.g. cache}

Definition statement

This subgroup covers:

Cache memories being part of a memory hierarchy. Information not provided for in the sub-groups is classified in this group, e.g. aspects relating to cache configuration, error handling or testing.

References relevant to classification in this group

This subgroup does not cover:

Caching of dynamically generated content, e.g. database query cache, web cache.	G06F 17/30
Register cache (for register file).	G06F 9/30
Branch history / target cache.	G06F 9/38

Special rules of classification within this group

Indexing Code groups [G06F 2212/27](#), [G06F 2212/30](#), [G06F 2212/45](#), [G06F 2212/60](#) are mandatory in this group when applicable.

G06F 12/0804

{with main memory updating ([G06F 12/0806](#) takes precedence; see provisionally also [G06F 12/12](#))}

Definition statement

This subgroup covers:

Write-back of dirty data to main memory.

Saving or preservation of dirty data in case of errors or power failure

Write-back policies, e.g. selective write-through / write-back.

References relevant to classification in this group

This subgroup does not cover:

Multiuser, multiprocessor, multiprocessing cache systems e.g. write-back due to coherency protocol transactions.	G06F 12/0806
Replacement policies	G06F 12/12

Informative references

Attention is drawn to the following places, which may be of interest for search:

Data backup to prevent data loss.	G06F 11/14
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G06F 12/0806

{Multiuser, multiprocessor, multiprocessing cache systems}

Special rules of classification within this group

Indexing Codes [G06F 2212/62](#) are mandatory in this group.

G06F 12/0815

{Cache consistency protocols}

Definition statement

This subgroup covers:

Cache coherency protocols, e.g. snooping, directory based or software controlled. Further details of subgroups

[G06F 12/0833](#): this group is not used for classification of new material, use [G06F 12/0831](#).

References relevant to classification in this group

This subgroup does not cover:

Memory consistency not specific to cache coherency.	G06F 9/46
Locking for the purpose of program synchronization	G06F 9/52

Special rules of classification within this group

The group [G06F 12/0815](#) should only be used for material not provided for in any of the subgroups [G06F 12/0817](#)-[G06F 12/0837](#).

G06F 12/0844

{Multiple simultaneous or quasi-simultaneous cache accessing}

Definition statement

This subgroup covers:

Simultaneous processing of two or more accesses.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Pipeline techniques within processors	G06F 9/38
Module addressing in general	G06F 12/06

G06F 12/0862

{with prefetch}

Definition statement

This subgroup covers:

Prefetching in cache memory using fixed or adaptive prefetch strategies.

Software controlled prefetching using prefetch instructions.

Use of dedicated prefetch buffer or prefetch cache.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Compiling techniques to reduce cache misses	G06F 8/4442
Instruction or operand prefetching within processors	G06F 9/38

Special rules of classification within this group

For prefetching in disk caches this class should be combined with Indexing Code [G06F 12/0866](#).

Indexing Code group [G06F 2212/602](#) is mandatory in this group. The coding of the existing documentation is mostly complete.

G06F 12/0864

{using pseudo-associative means, e.g. set-associative, hashing}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Page mode accessing of cache	G06F 12/0882
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Special rules of classification within this group

Indexing Code [G06F 2212/6032](#) is mandatory for material dealing with way prediction. The coding of the existing documentation is mostly complete.

G06F 12/0866

{for peripheral storage systems, e.g. disk cache}

Definition statement

This subgroup covers:

Dedicated cache memory within storage controller or storage device;

Caching of network attached storage or remote server content;

Disk caching in main memory of host computer, e.g. by operating system.

References relevant to classification in this group

This subgroup does not cover:

Caching of dynamically generated data content, e.g. web caching, database query results	G06F 17/30
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Storage adapters, disk storage management	G06F 3/06
Temporary data storage in networks	H04L 67/2842

Special rules of classification within this group

Indexing Code groups [G06F 2212/21](#), [G06F 2212/22](#), [G06F 2212/26](#), [G06F 2212/28](#), [G06F 2212/31](#) and [G06F 2212/46](#) are mandatory in this group.

If the invention information can be fully classified in other group(s) it is recommended to add only Indexing Code [G06F 12/0866](#).

G06F 12/0868

{Data transfer between cache memory and other subsystems, e.g. storage devices or host systems}

Definition statement

This subgroup covers:

Data transfer control within the cache system, between the cache and the storage devices or between the cache and the host system.

E.g. concurrent transfers, internal buffering arrangements, pipelining.

References relevant to classification in this group

This subgroup does not cover:

Replacement control	G06F 12/12
Write back control	G06F 12/0804

G06F 12/0871**{Allocation and management of cache space}****Definition statement***This subgroup covers:*

Allocation of cache space.

Organisation of cache data, data structures therefore.

Free space management within cache.

References relevant to classification in this group*This subgroup does not cover:*

Replacement control	G06F 12/12
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G06F 12/0873**{Mapping of cache memory to specific storage devices or parts of a storage device}****Definition statement***This subgroup covers:*

Selective allocation of (parts of) cache memory space to specific storage devices or parts of such devices.

This group is limited to large granularity mapping of cache areas to portions of a storage system, e.g. allocating cache partitions to individual storage devices.

References relevant to classification in this group*This subgroup does not cover:*

Set-associative or similar mappings of individual cache entries to storage device locations.	G06F 12/0864
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G06F 12/0875

{with dedicated cache, e.g. instruction or stack}

Definition statement

This subgroup covers:

Cache memories adapted for particular applications or specific types of data, e.g. stack caches, instruction caches, caches for graphics information.

References relevant to classification in this group

This subgroup does not cover:

Branch history cache, branch target cache	G06F 9/38
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Special rules of classification within this group

Indexing Code group [G06F 2212/45](#) is used in this group.

Warning: Except for [G06F 2212/451](#) these codes have not yet been allocated to the existing documentation.

G06F 12/0877

{Cache access modes}

Definition statement

This subgroup covers:

Special access modes to cache memory, e.g. burst mode access, partial line accessing.

G06F 12/0888

{using selective caching, e.g. bypass}

Definition statement

This subgroup covers:

Selective or conditional caching of data, e.g. based on expected usefulness of caching;

Bypassing of cache.

G06F 12/0891**{using clearing, invalidating or resetting means}****Definition statement***This subgroup covers:*

Invalidation of the entire cache memory content or parts of the cache memory content, e.g. upon initialization or task switching;

Hardware techniques for cache memory invalidation.

References relevant to classification in this group*This subgroup does not cover:*

Invalidation forming part of a cache coherency protocol	G06F 12/0815
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Informative references*Attention is drawn to the following places, which may be of interest for search:*

Main memory updating, e.g. flushing of cache content	G06F 12/0804
Initialisation circuits for static stores	G11C 7/20 , G11C 11/40

G06F 12/0893**{Organization and technology of caches}****Definition statement***This subgroup covers:*

Cache topology;

Cache structurally integrated within a memory device, e.g. DRAM row cache;

Cache employing DRAM or other technology than SRAM.

Informative references*Attention is drawn to the following places, which may be of interest for search:*

Static stores in general	G11C
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Special rules of classification within this group

Indexing Code [G06F 2212/305](#) is mandatory for memory with integrated cache memory, e.g. cache DRAM. The coding of the existing documentation is mostly complete.

Indexing Code groups [G06F 2212/22](#) and [G06F 2212/27](#) are used in this group.

G06F 12/10

Address translation

Definition statement

This subgroup covers:

Virtual to physical address translation;

Translation fault handling;

Virtual address space management, see provisionally also [G06F 12/0284](#).

References relevant to classification in this group

This subgroup does not cover:

Address mapping within flash memory	G06F 12/0246
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Multi-user or multiprocessor address space allocation	G06F 12/0284
Address mapping or translation in general, not specific to virtual memory	G06F 12/0292
Virtual machines.	G06F 9/455
Logical partitioning	G06F 9/50

Special rules of classification within this group

Indexing Codes [G06F 2212/65](#)- [G06F 2212/657](#) are used in this group. The coding of the existing documentation is mostly complete.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Page	The unit of paging in virtual memory
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G06F 12/1027

{using associative or pseudo-associative address translation means, e.g. translation look-aside buffer [TLB]}

Definition statement

This subgroup covers:

Caching of address translations;

TLB miss handling.

Special rules of classification within this group

Indexing Code group [G06F 2212/681-G06F 2212/684](#) is used in this group. The coding of the existing documentation is mostly complete.

Replacement control for TLB's is classified in [G06F 12/12-G06F 12/128](#). An Indexing Code [G06F 12/1027](#) should be allocated in such cases.

Synonyms and Keywords

In patent documents the following abbreviations are often used:

TLB	Translation Look-aside Buffer
MMU	Memory Management Unit

G06F 12/1081

{for peripheral access to main memory, e.g. DMA}

Definition statement

This subgroup covers:

Address translation for peripheral devices, channels, I/O adapters, network adapters, DMA controllers etc.

Memory management units within such devices or interfaces.

G06F 12/109

{for multiple virtual address spaces, e.g. segmentation}

Definition statement

This subgroup covers:

Translation for multiple virtual address spaces, e.g. identified by an address space identifier;

Segmentation based on a segment identifier;

Guest address space to host address space translation.

Special rules of classification within this group

Indexing Codes [G06F 2212/656](#) and [G06F 2212/657](#) are particularly relevant in this group.

G06F 12/12

Replacement control

Definition statement

This subgroup covers:

Replacement control in virtual memory, cache memory or TLB.

Replacement algorithms.

References relevant to classification in this group

This subgroup does not cover:

Write back control in cache	G06F 12/0804
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Synonyms and Keywords

In patent documents the following abbreviations are often used:

LFU	Least Frequently Used
LRU	Least Recently Used
MRU	Most Recently Used
FIFO	First In First Out

G06F 12/14

Protection against unauthorised use of memory {or access to memory (security arrangements for protecting computers or computer systems against unauthorised activity [G06F 21/00](#); multiprogramming arrangements [G06F 9/46](#))}

Definition statement

This subgroup covers:

Preventing unauthorized access to memory content.

Virtual memory access control.

References relevant to classification in this group

This subgroup does not cover:

Program synchronization, e.g. using locks; mutual exclusion	G06F 9/52
Protection of storage carriers such as disk devices	G06F 21/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Security arrangements in computers	G06F 21/00
Coded identity card or credit card	G07F 7/08
Secure communication	H04L 9/00
Multiprogramming arrangements	G06F 9/46

G06F 12/1408

{by using cryptography (for digital transmission [H04L 9/00](#))}

Definition statement

This subgroup covers:

Address scrambling;

Data encryption within a memory, e.g. being dependent on the memory location.

References relevant to classification in this group

This subgroup does not cover:

Data encryption being independent of the memory location	G06F 21/00
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Secure communication	H04L 9/00
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G06F 12/1416

{by checking the object accessibility, e.g. type of access defined by the memory independently of subject rights ([G06F 12/1458](#) takes precedence)}

Definition statement

This subgroup covers:

Memory protection being independent of the subject identity, e.g. physical write protection of a memory.

References relevant to classification in this group

This subgroup does not cover:

By checking the subject access rights	G06F 12/1458
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G06F 12/1458

{by checking the subject access rights}

Definition statement

This subgroup covers:

Memory protection in which the protection depends on the subject identity, e.g. using an access list.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Access list protection in general	G06F 21/00
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G06F 12/16

Protection against loss of memory contents {(contains no material, see [G06F 11/00](#))}

Relationship between large subject matter areas

This group is not used for classification and contains no material. Documents relating to protection against loss of memory content are classified within main group [G06F 11/00](#), in particular in the groups [G06F 11/14](#) or [G06F 11/16](#).

References relevant to classification in this subclass/group

This subgroup does not cover:

Protection against loss of memory contents	G06F 11/00
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G06F 13/00

Interconnection of, or transfer of information or other signals between, memories, input/output devices or central processing units (interface circuits for specific input/output devices [G06F 3/00](#); multiprocessor systems [G06F 15/16](#); transmission of digital information in general [H04L](#); selecting [H04Q](#); {multiprogramme control therefor [G06F 9/46](#)})

References relevant to classification in this group

This group does not cover:

Multi-processor systems	G06F 15/16
Interface circuits for specific input/output devices	G06F 3/00
Multiprogram control therefor	G06F 9/46
Transmission of digital information in general	H04L
Transmission of digital information through air	H04Q , H04W

G06F 13/28

using burst mode transfer, e.g. direct memory access {DMA}, cycle steal ([G06F 13/32](#) takes precedence)

Definition statement

This subgroup covers:

Handling requests for interconnection or transfer using burst mode transfer, e.g. direct memory access.

References relevant to classification in this group

This subgroup does not cover:

Access to input/output bus using combination of interrupt and burst mode transfer	G06F 13/32
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Remote DMA	H04L 12/06
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G06F 13/382

{using universal interface adapter}

Definition statement

This subgroup covers:

Information transfer, e.g. on bus using universal interface adapter.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Digital I/O from or to direct access storage devices	G06F 3/0689
Wireless network data management	H04W

Special rules of classification within this group

The information transfer is between components in a computer. Therefore, documents classified in this subgroup should relate to a data transfer in, to or from a computer.

G06F 13/4004

{Coupling between buses}

References relevant to classification in this group

This subgroup does not cover:

Network bridges	H04L 12/46
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G06F 13/4063

{Device-to-bus coupling}

Relationship between large subject matter areas

Documents classified in this subgroup can also be related to some pins configuration, and more also to system configuration.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Booting configuration	G06F 9/445
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G06F 13/4081

{Live connection to bus, e.g. hot-plugging (current or voltage limitation during live insertion [H02H 9/004](#))}

Definition statement

This subgroup covers:

Bus structure electrical coupling between device and bus; Live connection to bus, e.g. hot plugging.

References relevant to classification in this group

This subgroup does not cover:

Current or voltage limitation during live insertion	H02H 9/004
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Special rules of classification within this group

Documents related to detection of presence and/or type of connected peripheral can be classified in this subgroup.

G06F 13/409

{Mechanical coupling (Back panels [H05K 7/1438](#))}

Definition statement

This subgroup covers:

Bus structure based on a mechanical coupling between device and bus.

References relevant to classification in this group

This subgroup does not cover:

Back panels	H05K 7/1438
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Computer enclosure	G06F 1/16
Electrical connector	H01R 13/00

Special rules of classification within this group

Documents related to mechanical coupling between a computer component and a bus can be classified in this subgroup, e.g. coupling of connectors or boards to a computer bus.

G06F 15/00

Digital computers in general (details [G06F 1/00](#) - [G06F 13/00](#)); Data processing equipment in general (neural networks for image data processing [G06T](#))

References relevant to classification in this group

This group does not cover:

Details of digital computers	G06F 1/00 - G06F 13/00
Neural networks for image data processing	G06T

G06F 15/02

manually operated with input through keyboard and computation using a built-in programme, e.g. pocket calculators

Definition statement

This subgroup covers:

Pocket calculators, e-books, PDA.

References relevant to classification in this group

This subgroup does not cover:

Constructional details or arrangements for portable computers	G06F 1/1613
Input arrangements or combined input and output arrangements for interaction between user and computer	G06F 3/01

Special rules of classification within this group

When a document qualifies for one of the classes below, the class [G06F 15/02](#) should not be assigned:

For combination with other devices having a different main function, e.g. watches, pens: [G06F 15/0208](#)

Constructional details or arrangements: [G06F 15/0216](#)

User interface arrangements, e.g. keyboard, display; Interfaces to other computer systems: [G06F 15/0225](#)

With printing provisions: [G06F 15/0233](#)

Of the IC-card-like type: [G06F 15/0241](#)

Adapted to a specific application: [G06F 15/025](#)

For unit conversion: [G06F 15/0258](#)

For time management, e.g. calendars, diaries: [G06F 15/0266](#)

For measuring: [G06F 15/0275](#)

For data storage and retrieval: [G06F 15/0283](#)

For reading: [G06F 15/0291](#)

G06F 15/16

Combinations of two or more digital computers each having at least an arithmetic unit, a programme unit and a register, e.g. for a simultaneous processing of several programmes {(coordinating programme control therefor [G06F 9/52](#); in regulating and control system [G05B](#))}

Definition statement

This subgroup covers:

MIMD, SPMD Architectures.

Relationship between large subject matter areas

Documents classified in this subgroup can also be related to digital computers for regulating and control system ([G05B](#)).

References relevant to classification in this group

This subgroup does not cover:

Control area networks (CAN)	B60R 16/023
Multiprocessor for program-control systems	G05B 19/0421
Constructional details on portable computers, PDAs	G06F 1/1613
Fault-tolerance	G06F 11/20
Memory protection	G06F 12/00
Memory access priority	G06F 13/00
Coupling between busses	G06F 13/4022
Multicore processors	G06F 15/7807
Network on chip	G06F 15/7825
Digital computing or data processing equipment or methods, specially adapted for data retrieval.	G06F 17/30

Initialization of multiprocessor systems.	G06F 9/4405
Intertask communication	G06F 9/54
Partitioning or combining resources in a multiprogramming arrangement.	G06F 9/5061
Data processing systems or methods, specially adapted for administrative, commercial, financial, managerial, supervisory or forecasting purposes; systems or methods specially adapted for administrative, commercial, financial, managerial, supervisory or forecasting purposes.	G06Q
Computer aided management of electronic mail	G06Q 10/107
Stored and forward switching systems	H04L 12/54
Routing of packets in a LAN/WAN	H04L 12/5689
Flow Control in a LAN/WAN	H04L 12/569
Queue Scheduling in a LAN/WAN	H04L 12/5693
Packet switches for a LAN/WAN	H04L 12/5696
Electronic mail systems	H04L 12/58
Communication control characterized by a protocol.	H04L 29/06
Casings, cabinets, racks, chassis, drawers for data centers	H05K 5/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

coordinating program control therefor	G06F 9/52
in regulating and control system	G05B

Special rules of classification within this group

When a document qualifies for one of the classes below, none of the classes above should not be assigned:

Computing Infrastructure, e.g. cluster racks: [G06F 15/161](#)

Inter-processor communication: [G06F 15/163](#)

Using a common memory e.g. mailbox, dual port memory, UMA, NUMA architectures: [G06F 15/167](#)

Using an interconnection network e.g. message passing architectures: [G06F 15/173](#)

Direct connection machines e.g. point to point topologies, buses, (partial) crossbars: [G06F 15/17337](#)

Being dynamically configurable e.g. loosely coupled nearest neighbour architecture: [G06F 15/17343](#)

Indirect interconnection networks (one or several nodes are traversed before reaching destination): [G06F 15/17356](#)

Hierarchical e.g. trees, pyramides: [G06F 15/17362](#)

Non-hierarchical: [G06F 15/17368](#)

On one dimension e.g. linear arrays,rings: [G06F 15/17375](#)

On two dimensions e.g. mesh, torus:[G06F 15/17381](#)

Topologies not covered by groups [G06F 15/17375](#) or [G06F 15/17381](#):
[G06F 15/17387](#)

Intercommunication techniques specific to parallel machines: [G06F 15/17306](#)

Routing: [G06F 15/17312](#)

Collective communications e.g. gather/scatter, broadcast, multicast, all to all:
[G06F 15/17318](#)

Synchronization, hardware support therefore: [G06F 15/17325](#)

Distributed shared memory, hardware support therefore e.g. RDMA:
[G06F 15/17331](#)

Details on network interfaces: [G06F 15/1735](#)

Initialisation or configuration control: [G06F 15/177](#)

Here are specified the classes which could be assigned in addition to the classes above to cover further technical details:

G06F 15/76

Architectures of general purpose stored programme computers (with programme plugboard [G06F 15/08](#); multicomputers [G06F 15/16](#), general purpose image data processing [G06T 1/00](#))

Definition statement

This subgroup covers:

System on Board, System on Chip, Reconfigurable Architectures, Data-Parallel Architectures (Vector Architectures, SIMD, Systolic Arrays), Dataflow Architectures, Demand Driven Architectures.

Relationship between large subject matter areas

Documents classified in this subgroup can also be related to general purpose image data processing ([G06T](#)).

References relevant to classification in this group

This subgroup does not cover:

Generating or distributing clock signals or signals derived directly therefrom.	G06F 1/04
Memory addressing, virtual memory, memory caches, memory access rights.	G06F 12/00
Transfer of data to/from memory or peripherals	G06F 13/00
Loosely connected stored program computers, interconnections or intercommunication systems	G06F 15/16
Data processing equipment or methods specially adapted for complex mathematical operations	G06F 17/10
Circuit design for FPGAs, mapping, optimisation.	G06F 17/5045
Circuits for multiplication/division	G06F 7/52
Concurrent instruction execution, multistreaming	G06F 9/3851
Concurrent instruction execution, pipeline.	G06F 9/3867
Concurrent instruction execution, using a slave processor.	G06F 9/3877
Concurrent instruction execution, using a plurality of independent parallel functional units	G06F 9/3885
Assemblies consisting of a plurality of individual semiconductor or other solid state devices	H01L 25/00
Logic circuits arranged in matrix form e.g. PLDs, FPGAs	H03K 19/177
Routing of packets in a LAN/WAN	H04L 12/5689
Flow Control in a LAN/WAN	H04L 12/569

Queue Scheduling in a LAN/WAN	H04L 12/5693
Packet switches for a LAN/WAN	H04L 12/5696
Processing of video data.	H04N 21/23
Mounting supports, back panels, stackable IC modules	H05K 7/14

Informative references

Attention is drawn to the following places, which may be of interest for search:

Digital computers with program plugboard	G06F 15/08
Multicomputers	G06F 15/16
general purpose image data processing G06T 1/00	G06T 1/00

Special rules of classification within this group

In general, when a document qualifies for one of the subclasses below, there is no need to assign any of the superclasses:

Comprising a single central processing unit: [G06F 15/78](#)

System on Board: computer system on one or more PCB e.g. motherboards, daughterboards, blades: [G06F 15/7803](#)

System on Chip: computer system on a single chip: [G06F 15/7807](#)

System in Package: computer system on a number of chips in a single package: [G06F 15/7807](#)

On-chip cache, off-chip memory: [G06F 15/781](#)

Specially adapted for real time processing e.g. comprising hardware timers :[G06F 15/7814](#)

Specially adapted for signal processing e.g. Harvard Architectures: [G06F 15/7817](#)

Tightly coupled to memory e.g. computational memory, smart memory, processor in memory: [G06F 15/7821](#)

Globally asynchronous , locally synchronous e.g. Network on Chip: [G06F 15/7825](#)

Reconfigurable architectures: [G06F 15/7867](#)

Reconfiguration support e.g. configuration loading, configuration switching (hardware OS): [G06F 15/7871](#)

Self reconfiguration: [G06F 15/7882](#)

Multiple Contexts: [G06F 15/7875](#)

Pipeline reconfiguration: [G06F 15/7878](#)

Runtime Interface e.g. data exchange, runtime control: [G06F 15/7885](#)

Embedded in CPU as a functional unit: [G06F 15/7892](#)

As a coprocessor: [G06F 15/7889](#)

Modular architectures e.g. assembled from a number of identical packages: [G06F 15/7896](#)

Comprising an array of processing units with common control, e.g. single instruction multiple data processors: [G06F 15/80](#)

SIMD multiprocessors: [G06F 15/8007](#)

One dimensional arrays e.g. rings, linear arrays, buses: [G06F 15/8015](#)

Two dimensional arrays. i.e. mesh, torus: [G06F 15/8023](#)

Other topologies.e.g. hypercubes: [G06F 15/803](#)

Associative processors: [G06F 15/8038](#)

Systolic arrays: [G06F 15/8046](#)

Vector Processors: [G06F 15/8053](#)

Details on exchanging data with memory: [G06F 15/8061](#)

Using a cache: [G06F 15/8069](#)

Details on exchanging data with registers: [G06F 15/8076](#)

Special arrangements thereof.e.g. mask, switch: [G06F 15/8084](#)

Array of vector units: [G06F 15/8092](#)

Data or demand driven: [G06F 15/82](#)

Dataflow computers: [G06F 15/825](#)

Here are specified the classes which could be assigned in addition to the classes above to cover further technical details:

Indexing Code [G06F 3/0604](#) finite state machines: controlled by or implementing FSM

G06F 17/10

Complex mathematical operations {(function generation by table look-up [G06F 1/03](#); evaluation of elementary functions by calculation [G06F 7/544](#))}

Definition statement

This subgroup covers:

Algorithms for:

- performing complex mathematical operations (e.g. matrix-vector multiplication [G06F 17/16](#), discrete Fourier transform [G06F 17/141](#));
- solving generic mathematical problems (e.g. system of linear equations [G06F 17/12](#));
- manipulating mathematical objects (e.g. matrix factorization [G06F 17/16](#));

evaluating complex mathematical functions (e.g. by interpolation of known function values [G06F 17/17](#));

- computing statistical descriptions of data sets (e.g. histogram computation [G06F 17/18](#))
- mathematical analysis of data not provided elsewhere (e.g. mathematical spectral analysis algorithms based on the discrete Fourier transform [G06F 17/141](#)) and the implementation of such algorithms
- as computer programs (for general-purpose digital processors), eventually with specially adapted data structures for storing the mathematical objects upon which the operations are performed (e.g. specific matrix storage formats), or
- as dedicated digital hardware circuits, described on the level of adders, subtractors, multiplexers, etc.

The groups in [G06F 17/10](#) are function-oriented and are intended to cover mathematical methods and devices which are in principle not tied to a particular application field.

To be classified in [G06F 17/10](#) and subgroups, a document should not merely disclose how a (technical) problem in an application field is reduced to a particular mathematical problem (e.g. a particular set of equations) but it must also disclose details of the mathematical algorithm used to solve this particular mathematical problem. Furthermore, the mathematical problem and/or the mathematical algorithm used to solve it should also be sufficiently generic in the sense that they may be relevant outside the particular application field (even if this fact is not mentioned in the document itself).

Subject-matter classified in group [G06F 17/10](#) itself (because it does not fall in any of the subgroups) includes among others:

- Numerical computation of the derivative of a function;
- Numerical integration of a function, e.g. Using monte-carlo methodology;
- Methods enabling symbolic mathematical calculations, e.g. In computer algebra systems;
- Graph algorithms not classified elsewhere.

Relationship between large subject matter areas

When a document discloses a mathematical algorithm applied in a particular application field, classification in the relevant application-related group(s) should also be considered.

References relevant to classification in this group

This subgroup does not cover:

Function generation working, at least partially, by table look-up	G06F 1/03
Computational arithmetic, e.g. number representation systems (e.g. conversion between number formats, rounding issues in fixed-point / floating-point arithmetic) implementation of arithmetic operations (addition, subtraction, multiplication, division), also for complex numbers (e.g. using CORDIC)	G06F 7/00
Evaluation of elementary functions (e.g. trigonometric functions, power, roots, logarithmic and exponential functions) by calculation	G06F 7/544
Arithmetic circuits for sum of products per se, e.g. multiply-accumulators (MACs)	G06F 7/5443
Arithmetic logic units (ALUs)	G06F 7/57
Generation of random or pseudo-random numbers	G06F 7/58
Digital differential analysers	G06F 7/64
Computational residue arithmetic, e.g. modular inversion or exponentiation; computational elliptic curve arithmetic	G06F 7/72
Basic logic circuits (e.g. AND, NAND, OR)	H03K 19/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Reservoir modelling	E21B 49/00
Geophysics, seismic data analysis	G01V 1/28

Computer-aided design and simulation	G06F 17/50
Pattern recognition, e.g. classification algorithms	G06K 9/00
Neural networks	G06N 3/02
Genetic algorithms	G06N 3/126
Computer systems using knowledge base models	G06N 5/00
Computer systems based on specific mathematical models	G06N 7/00
Probabilistic networks, e.g. Bayesian networks	G06N 7/005
Using fuzzy logic	G06N 7/02
Image processing	G06T
Digital filters	H03H 17/00
Data compression in general	H03M 7/30
Coding/decoding in general	H03M 13/00
Decoding based on Viterbi algorithm	H03M 13/41

Special rules of classification within this group

A document disclosing a device which is configurable to perform several complex mathematical operations (e.g. a circuit configurable to perform either a DFT or a convolution operation) is to be classified in the relevant groups ([G06F 17/141](#) and [G06F 17/15](#)) if the document discloses details of the computations which are specific to the different mathematical operations. However, if no such details are provided, the document is to be classified only in the broadest group covering these operations. For example, a document disclosing a circuit able to perform any linear transform, including DFT and DCT, without providing details specific to the DFT or DCT computations, is to be classified only in [G06F 17/14](#).

G06F 17/11

for solving equations {, e.g. nonlinear equations, general mathematical optimization problems (optimization specially adapted for a specific administrative, business or logistic context [G06Q 10/04](#))}

Definition statement

This subgroup covers:

- Solving non-linear equations (e.g. By iterative methods)
- Mathematical algorithms for solving general mathematical optimization problems (e.g. Linear, non-linear, mixed-integer or combinatorial optimization problems)

Relationship between large subject matter areas

The use of mathematical optimization to solve a problem in an administrative, business or logistic context is usually classified in [G06Q 10/04](#). However, if the document provides also details regarding the mathematical algorithm used for solving the resulting mathematical optimization problem and if the mathematical optimization problem and/or the mathematical algorithm are sufficiently generic (i.e. if they may be relevant outside the particular application context), the document should also be classified in [G06F 17/11](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Computer-aided design, e.g. circuit design, network design	G06F 17/50
Dynamic search techniques, heuristics, branch-and-bound used in computer systems utilising knowledge based models	G06N 5/003
Optimization specially adapted for a specific administrative, business or logistic context	G06Q 10/04

G06F 17/12

Simultaneous equations {, e.g. systems of linear equations}

Definition statement

This subgroup covers:

Methods for solving systems of linear equations $Ax=b$, e.g. by direct or iterative methods.

Special rules of classification within this group

Details of matrix factorization algorithms or matrix storage formats used in the context of a specific method for solving a system of linear equations are additionally classified in [G06F 17/16](#) if they are per se relevant.

G06F 17/13

Differential equations (using digital differential analysers [G06F 7/64](#))

Definition statement

This subgroup covers:

- Solving ordinary or partial differential equations.
- Qualitative analysis of dynamical systems, e.g. Determining attractors.

References relevant to classification in this group

This subgroup does not cover:

Solving differential equations using digital differential analysers	G06F 7/64
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Adaptive control systems	G05B 13/00
Creation and adaptation of a mathematical model used to control a system	G05B 17/00
Computer-aided design	G06F 17/50
Simulation using finite difference or finite element methods	G06F 17/5018

G06F 17/14

Fourier, Walsh or analogous domain transformations, {e.g. Laplace, Hilbert, Karhunen-Loeve, transforms (for correlation function computation [G06F 17/156](#); spectrum analysers [G01R 23/16](#))}

Definition statement

This subgroup covers:

- Efficient computation of domain transforms
- By extension, [G06F 17/14](#) and its subgroups (in particular [G06F 17/141](#) and [G06F 17/148](#)) do also include
- General mathematical algorithms for spectral analysis based on a domain transform (e.g. a method for DFT resolution enhancement by zero-padding is classified in [G06F 17/141](#))
- Domain transforms not covered by its subgroups, e.g. Laplace, Hilbert or Karhunen-Loève transforms. It does also cover devices enabling computation of broad classes of domain transforms.

References relevant to classification in this group

This subgroup does not cover:

Spectral and Fourier analysis devices, e.g. digital spectrum analysers, in which the focus is on the electrical signal measurement apparatus and not on a mathematical spectral analysis algorithm	G01R 23/16
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Correlation function computation using a domain transform	G06F 17/156
Frequency selective networks using specific transformation algorithms	H03H 17/0211

G06F 17/141

{Discrete Fourier transforms}

Definition statement

This subgroup covers:

- Discrete Fourier Transform (DFT) computation, e.g. partial DFT, Goerzel method, recursive DFT computation, short-time DFT

Fast Fourier Transform (FFT) and Prime Factor algorithms for computing the DFT and corresponding devices are classified in subgroups.

By extension, [G06F 17/141](#) also includes:

- general mathematical algorithms for spectral analysis based on the DFT, e.g. DFT resolution enhancement by zero-padding

Informative references

Attention is drawn to the following places, which may be of interest for search:

Multi-carrier modulation systems	H04L 27/2601
Inverse Fourier transform modulators	H04L 27/2628
IFFT/IDFT in combination with other circuits for modulation	H04L 27/2634
Fourier transform demodulators	H04L 27/265

G06F 17/142

{Fast Fourier transforms, e.g. using a Cooley-Tukey type algorithm}

Definition statement

This subgroup covers:

- DFT computation by means of a Fast Fourier Transform (FFT) algorithm, e.g. Cooley-Tukey or mixed-radix type
- processing elements specially adapted for FFT butterfly operations
- memory addressing schemes specially adapted for FFT computation

G06F 17/144

{Prime factor Fourier transforms, e.g. Winograd transforms, number theoretic transforms}

Definition statement

This subgroup covers:

- prime factor algorithm (PFA) or Good-Thomas algorithm
- Winograd Fourier transform algorithm (WFTA)

G06F 17/145

{Square transforms, e.g. Hadamard, Walsh, Haar, Hough, Slant transforms}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Direct-sequence spread-spectrum techniques, e.g. CDMA	H04B 1/707
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G06F 17/147

{Discrete orthonormal transforms, e.g. discrete cosine transform, discrete sine transform, and variations therefrom, e.g. modified discrete cosine transform, integer transforms approximating the discrete cosine transform ([G06F 17/145](#) takes precedence)}

Definition statement

This subgroup covers:

- Discrete Cosine Transform (DCT)
- Discrete Sine Transform (DST)
- Modified Discrete Cosine Transform (MDCT)
- Integer transforms approximating the DCT, e.g. IntDCT

References relevant to classification in this group

This subgroup does not cover:

Square transforms, e.g. Hadamard transform	G06F 17/145
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Coding or decoding of speech or audio signals	G10L 19/00
Discrete cosine transform modulators in multi-carrier modulation systems	H04L 27/2639
Transform-based video coding	H04N 19/60
The transform being DCT	H04N 19/625

G06F 17/148

{Wavelet transforms}

Definition statement

This subgroup covers:

- Fast Wavelet Transform.
- Integer Wavelet Transform.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Transform-based video coding, the transform being sub-band based, e.g. wavelets	H04N 19/63
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G06F 17/15

Correlation function computation {including computation of convolution operations (arithmetic circuits for sum of products per se, e.g. multiply-accumulators [G06F 7/5443](#); digital filters, e.g. FIR, IIR, adaptive filters [H03H 17/00](#))}

Definition statement

This subgroup covers:

- Correlation computations, e.g. Sliding correlation, cross-correlation, auto-correlation
- Convolution operations

References relevant to classification in this group

This subgroup does not cover:

Arithmetic circuits for sum of products per se, e.g. multiply-accumulators (MACs)	G06F 7/5443
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Pattern recognition	G06K 9/00
Convolution neural network	G06N 3/02
Digital filters, e.g. FIR, IIR, adaptive filters	H03H 17/00
Direct-sequence spread-spectrum techniques, e.g. CDMA	H04B 1/707

G06F 17/153

{Multidimensional correlation or convolution}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Convolution neural network	G06N 3/02
Image enhancement, e.g. noise filtering, using multidimensional convolution operations	G06T 5/00

G06F 17/156

{using a domain transform, e.g. Fourier transform, polynomial transform, number theoretic transform}

Definition statement

This subgroup covers:

FFT-based correlation and convolution.

G06F 17/16

Matrix or vector computation, {e.g. matrix-matrix or matrix-vector multiplication, matrix factorization (matrix transposition [G06F 7/78](#))}

Definition statement

This subgroup covers:

- Matrix-matrix multiplication
- Matrix-vector multiplication
- Vector product, dot product computation
- Matrix inversion
- Matrix factorization, e.g. Svd, lu, qr, cholesky decompositions
- Matrix storage formats, e.g. For sparse matrices

- Software and hardware implementations thereof, e.g. a systolic array specially adapted for QR decomposition.

References relevant to classification in this group

This subgroup does not cover:

Matrix transposition	G06F 7/78
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Arrangements for executing machine-instructions	G06F 9/30
To perform operations on data operands, e.g. arithmetic instructions	G06F 9/30007
Concurrent instruction execution using a plurality of independent parallel functional units, e.g. SIMD, MIMD	G06F 9/3885
Architecture of general-purpose stored program computer	G06F 15/76
Reconfigurable architectures	G06F 15/7867
Architectures comprising an array of processing units, e.g. single instruction multiple data (SIMD) processors	G06F 15/80
Systolic arrays	G06F 15/8046
Vector processors	G06F 15/8053
Solving simultaneous equations, e.g. systems of linear equations	G06F 17/12

G06F 17/17

Function evaluation by approximation methods, e.g. inter- or extrapolation, smoothing, least mean square method ({[G06F 17/18](#) takes precedence } ; interpolation for numerical control [G05B 19/18](#))

References relevant to classification in this group

This subgroup does not cover:

Interpolation for numerical control	G05B 19/18
Evaluating statistical data, e.g. function fitting based on least-mean squares method	G06F 17/18

Informative references

Attention is drawn to the following places, which may be of interest for search:

Digital function generation working, at least partially, by table look-up; reduction of look-up table size	G06F 1/03
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G06F 17/175

{of multidimensional data}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Geometric Image transformation, e.g. interpolation-based scaling	G06T 3/00
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G06F 17/18

for evaluating statistical data, {e.g. average values, frequency distributions, probability functions, regression analysis (forecasting specially adapted for a specific administrative, business or logistic context [G06Q 10/04](#))}

Definition statement

This subgroup covers:

- Computing the (running) average of a set of data.
- Computation of confidence intervals.
- Computing a probability density function, e.g. An histogram, for a set of data.
- Regression analysis, e.g. Least-mean square methods for fitting a function to statistical data.
- General statistical analysis methods not covered elsewhere.

References relevant to classification in this group

This subgroup does not cover:

Computing the maximum, minimum or median value of a set of data	G06F 7/22
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Pattern recognition using clustering techniques	G06K 9/6217
Forecasting specially adapted for a specific administrative, business or logistic context	G06Q 10/04
Medical informatics	G06F 19/30
Bioinformatics	G06F 19/10

G06F 17/20

Handling natural language data (speech analysis or synthesis [G10L](#))

Definition statement

This subgroup covers:

- Text and natural language processing,
- Natural language understanding and translation,
- Processing of markup language,
- Spreadsheets.

Relationship between large subject matter areas

The mere use of XML or other markup language, e.g. as a file format for functional data such as configuration files, should not be classified here, but rather in the field in which the data is actually used.

References relevant to classification in this group

This subgroup does not cover:

Tape / Label printers (hardware)	B41J 3/4075
Parser generation for computer code	G06F 8/37
Parsing of computer code	G06F9/45
Translation, e.g. compilation, of computer code	G06F9/45
Translation to/from Braille or sign language	G09B 21/00
Text-to-speech	G10L 13/00
Speech-to-text	G10L 15/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Input/output for Oriental characters	G06F 3/018
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Predictive input	G06F 3/0237
Digital ink, low-level/hardware aspects thereof	G06F 3/04883
Printing (job control, etc.)	G06F 3/12
Multilingual user interfaces	G06F 9/4448
Text retrieval, creation of semantic tools	G06F 17/3061
Thesaurus (creation for retrieval)	G06F 17/30737
Website content management	G06F 17/3089
Retrieval of semistructured data	G06F 17/30908
Character generators for displays	G09G 5/22
Compression/encoding of unstructured text	H03M 7/30

Synonyms and Keywords

In patent documents the following abbreviations are often used:

XML	Extensible Markup Language
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G06F 17/30

Information retrieval; Database structures therefor; {File system structures therefor (data processing systems or methods specially adapted for administrative, commercial, financial managerial, supervisory or forecasting purposes [G06Q](#))}

Definition statement

This subgroup covers:

- Systems and methods for retrieving digital information stored in databases, data repositories or file systems, locally or remotely.
- Details of the organization and preparation of information for use during the retrieving of digital information, e.g. Generation of indexing information, query formulation.
- Details of data structures used for information retrieval, such as trees, lists, hashing.
- Details of query processing and the presentation of query results, e.g. In textual or graphical form on guis.
- Details of browsing digital information.
- Details of architectures of databases, data repositories or file systems, e.g. Physical, logical, virtual, central or distributed architectures.
- Details of managing data stored in databases, data repositories or file systems, e.g. Tuning, replication, archiving, synchronization, concurrency control, interfaces, guis.

- Details of optimizing the storage and retrieval of digital information, e.g. De-duplication of stored data, application-specific caching and pre-fetching in file systems, (distributed) databases or web browsers.
- Systems and methods for retrieving from and managing structured databases (e.g. Relational, object-oriented, multidimensional, spatial, temporal and geographical databases) and semi-structured data (e.g. XML formatted data, comma separated values).
- Systems and methods for retrieving text, audio, image, video and multimedia data from databases or for managing document libraries; systems and methods for internet information retrieval and browsing.

Relationship between large subject matter areas

- Content-based information retrieval in databases storing media data (e.g. audio, image or video data) involves the comparison of a search query with a corresponding representation of the data. Generation of the search query and the representation of the data can involve the analysis of the data and the subsequent low- and high-level feature extraction. [G06F 17/30](#) covers aspects of the actual process of comparison, e.g. similarity matching. The analysis and feature extraction is covered by [G06K 9/00](#), [G06T 7/00](#), [G10H](#) and [G10L](#), depending on the type of data.
- Distributed repositories involve the use of networks. Specific protocols for information interchange, including on the application layer are generally to be found under [H04L](#).
- Physical data storage details are generally found in [G06F 3/06](#), [G11B](#) or [G06F 12/00](#).
- The mere use of databases in specific application fields (e.g. administrative or financial processing systems) is covered by the respective application field (e.g. [G06Q](#)).

References relevant to classification in this group

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Searching in source code databases	G06F 9/44
Error recovery, backup, mirroring	G06F 11/14
CAD database applications	G06F 17/50
Medical, biological and chemical applications	G06F 19/00
Access control or security in information retrieval systems and repositories; anonymizing queries and database content	G06F 21/00
Pattern recognition	G06K 9/00

Business, financial and administrative related applications	G06Q 10/00 - G06Q 90/00
Image analysis	G06T 7/00
Musical instruments; music analysis	G10H
Speech analysis	G10L
Code conversion and compression	H03M 7/00
Network protocols, addressing and routing	H04L 29/00
Telephone directories in telephonic communication systems	H04M
Digital photography	H04N 1/21
TV guides, electronic programming guides, video distribution, interactive television, VOD (video on demand)	H04N 21/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

data processing systems or methods specially adapted for administrative, commercial, financial managerial, supervisory or forecasting purposes	G06Q
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Special rules of classification within this group

For documents dealing with how a given type of data is retrieved or how the database or repository for this particular type of data is organized, classification should generally take place in the indicated subgroup for the data type as follows:

- In multimedia databases - [G06F 17/30017](#)
- Geographical information - [G06F 17/30241](#)
- Still images - [G06F 17/30244](#)
- Structured information, records - [G06F 17/30286](#)
- Unstructured text - [G06F 17/3061](#)
- Audio information (e.g. music, speech) - [G06F 17/3074](#)
- Video information - [G06F 17/30781](#)
- Semi-structured information (e.g. XML, CSV) - [G06F 17/30908](#)

If however more than one particular data type is described in some detail, classification under each of the corresponding subgroup should be considered.

If no specific data type is indicated at all, or an explicit hint is given that the disclosed mechanism can be used for retrieval of arbitrary data types, e.g. a list of alternative data types, and for "generic" data type use subgroups under [G06F 17/30943](#).

In the case of annotated data/metadata-based retrieval, the type of data used for the retrieval is sometimes different than the data type to be finally retrieved (example: associated images used to retrieve text documents).

In this case, the classification should be decided according to the level of disclosed details concerning each aspect:

- according to the data type retrieved if the use of that metadata of different type is only casually described,
- according to the data type used for retrieval (type of the metadata) if specific details of this use are disclosed.

In the cases where both aspects are well covered, double classification can be warranted.

Note: Many problems with generic data types as under Rule 2 arise for documents describing querying systems/methods using metadata wherein the data type finally retrieved is arbitrary or doesn't really matter. Using the above approach, these documents can simply be classified under the data type used for the retrieval and under the metadata class in the generic data type subgroup. A similar approach can be applied in case of browsing a data type using a different data type.

- For example: browsing a set of audio files by browsing through the titles of the files or through images representing the audio files is to be classified under "browsing of audio data". In case some interesting aspects merit also a classification under text, respectively image browsing, this should be covered by double classification. Again, classification under "browsing of generic data" has to be considered.
- Additional information is classified by using EC symbols.

G06F 17/30011

{Document retrieval systems}

Definition statement

This subgroup covers:

- Organization of collections of digital documents (scanned, OCRred, semistructured or unstructured representation) in document library databases,
- Retrieval of digital representations of documents,

- Techniques for associating physical paper documents with their digital representation as stored in a database, e.g. by attaching barcodes to documents.

References relevant to classification in this group

This subgroup does not cover:

Retrieval of image data	G06F 17/30244
Retrieval of unstructured textual data	G06F 17/3061
Retrieval of semistructured data	G06F 17/30908

G06F 17/30014

{Hypermedia (hyperlinking within text processing [G06F 17/2235](#))}

Definition statement

This subgroup covers:

- Systems and methods for hyperlinking in documents.
- Computed links, including dynamically determined anchor and targets of links.
- Management of annotations linked to other documents.

References relevant to classification in this group

This subgroup does not cover:

Hyperlinking within text processing	G06F 17/2235
Navigation in hyperlinked Web environments	G06F 17/30873

G06F 17/30017

{Multimedia data retrieval; Retrieval of more than one type of audiovisual media (retrieval of image data [G06F 17/30244](#); retrieval of video data [G06F 17/30781](#); retrieval of audio data [G06F 17/3074](#); editing or indexing of data stored based on relative movement between record carrier and transducer [G11B 27/00](#))}

Definition statement

This subgroup covers:

- Retrieval of media data incorporating multiple media types, e.g. Slideshows comprising image and additional audio data.
- Retrieval of media data where the retrieval algorithm is suitable for various media types.

- Automatic creation of multi-media presentations or documents as a result of a query, e.g. Slide-shows, multimedia playlists, multimedia albums comprising various media types such as images, text, audio clips, video clips, etc.
- Adaptation of multimedia formats, e.g. Selection of multimedia formats based on the capabilities of a client.
- The generation of multimedia documents.
- Multimedia databases index structures and management thereof.

References relevant to classification in this group

This subgroup does not cover:

Retrieval of image data	G06F 17/30244
Retrieval of audio data	G06F 17/3074
Retrieval of video data	G06F 17/30781
Editing or indexing of data stored based on relative movement between record carrier and transducer	G11B 27/00

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Media type	the expression media type encompasses image data, audio data, video data and text data
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G06F 17/3002

{Indexing (indexing by using information signals detectable on the record carrier and recorded by the same method as the main recording [G11B 27/28](#))}

Definition statement

This subgroup covers:

Wherein the contribution is in specific indexing aspects.

References relevant to classification in this group

This subgroup does not cover:

Indexing by using information signals detectable on the record carrier and recorded by the same method as the main recording	G11B 27/28
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G06F 17/30023

{Querying (programmed access in sequence to addressed parts of tracks of operating discs [G11B 27/105](#))}

Definition statement

This subgroup covers:

Wherein the contribution is in specific query formulation aspects as defined in the subgroups.

References relevant to classification in this group

This subgroup does not cover:

Programed access in sequence to addressed parts of tracks of operating discs	G11B 27/105
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G06F 17/30026

{using audio data (details of audio retrieval [G06F 17/3074](#); general determination or detection of speech characteristics [G10L 25/00](#); speech recognition [G10L 15/00](#); speaker recognition [G10L 17/00](#); electrophonic musical instruments [G10H](#))}

Definition statement

This subgroup covers:

Query formulation using a piece of audio data as retrieval argument such as a selected audio file, music, which is currently playing, speech input, or environmental noises.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Details of audio retrieval	G06F 17/3074
Electrophonic musical instruments	G10H
General determination or detection of speech characteristics	G10L11/00
Speech recognition	G10L 15/00
Speaker recognition	G10L 17/00

G06F 17/30032

{using biological or physiological data of a human being, e.g. blood pressure, facial expression, gestures}

Definition statement

This subgroup covers:

Using biological or physiological metrics obtainable by monitoring the human body, (e.g. heart beat, pulse, body temperature, brain waves) or biometric techniques (e.g. fingerprint, iris or retina, face, voice or gait recognition) in formulation or personalization of queries.

G06F 17/30035

{Administration of user profiles, e.g. generation, initialisation, adaptation, distribution}

Definition statement

This subgroup covers:

Techniques for modelling the changing interest of a user over time including manual, semi-automatic or automatic initialization of user profiles, their maintenance and modification by monitoring the user's history of content selection, his history of interaction with the selected content, the management of the shared profile of a group of users, e.g. profile splitting, stereotyping.

G06F 17/30038

{based on information manually generated or based on information not derived from the media content, e.g. tags, keywords, comments, usage information, user ratings}

Definition statement

This subgroup covers:

Wherein the contribution is in retrieval or indexing of multimedia data using data not-derived from the media data or manually generated information, such as bibliographic information (e.g. title, composer, etc.), time and date information, usage information, user ratings, tags etc.

These data may be generated by automatic annotation of multimedia data, generation from existing data sources, e.g. data mining, collaborative annotation, creation of semantic ontologies, tagging.

G06F 17/30041**{using location information}****Definition statement***This subgroup covers:*

Where the feature used for retrieval or indexing is any kind of absolute, relative or fuzzy representation of location, e.g. GPS coordinates, postal address, rooms of a building, user's car.

G06F 17/30044**{using time information}****Definition statement***This subgroup covers:*

Where the feature used for retrieval or indexing is any kind absolute, relative or fuzzy representation of time, e.g. hour, date, time of the day, season of the year, rush hour, sunset, holiday.

G06F 17/30047**{using image data, e.g. images, photos, pictures taken by a user}****Definition statement***This subgroup covers:*

Query formulation using a piece of image data such as a selected image file, a photograph, which is currently captured by the camera of the user, a document, a barcode or scanned text.

G06F 17/3005**{Presentation of query results (menu, index or table of content presentation of record carriers [G11B 27/32](#), [G11B 27/34](#))}****Definition statement***This subgroup covers:*

Where invention information is present in the visual or acoustic presentation of the query results to the user.

Informative references*Attention is drawn to the following places, which may be of interest for search:*

Menu, index or table of content presentation of record carriers	G11B 27/32 , G11B 27/34
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G06F 17/30053**{by the use of playlists}****Definition statement***This subgroup covers:*

Methods or interfaces to create, modify and manage multimedia playlists.

G06F 17/30056**{Multimedia presentations, e.g. slide shows, multimedia albums}****Definition statement***This subgroup covers:*

Multimedia presentations of query results, e.g. slideshow presentations, photo albums enriched with multimedia content, e-books with multimedia content, etc.

G06F 17/30061**{Spatial browsing, e.g. 2D maps, 3D or virtual spaces (interaction with 3D GUI environments in general [G06F 3/04815](#))}****Definition statement***This subgroup covers:*

Using graphical representations of geographical, urban or virtual space, e.g. maps, city plans, virtual spaces, as a paradigm for browsing representations of multimedia objects.

Informative references*Attention is drawn to the following places, which may be of interest for search:*

Interaction with 3D GUI environments in general	G06F 3/04815
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G06F 17/30064**{Temporal browsing, e.g. timeline}****Definition statement***This subgroup covers:*

Using graphical representations of time, e.g. timelines, calendars, diaries, as a paradigm for browsing representations of multimedia objects.

G06F 17/30067

{File systems; File servers ([G06F 17/3061](#), [G06F 17/30017](#), [G06F 17/30244](#), [G06F 17/3074](#), [G06F 17/30781](#) take precedence; dedicated interfaces to storage systems [G06F 3/0601](#); error detection, correction or monitoring [G06F 11/00](#))}

Definition statement

This subgroup covers:

- Details of file systems and file servers. In particular, this group covers all aspects of generating, accessing and managing files. For a proper functioning of the file system management services are used by file system administrators to ensure that the file system provides the expected services, see the definitions below for the subgroup [G06F 17/3007](#). A file is an abstract data container used in file systems to manage a set of data. The internal structure of a file is normally not known by the file system, i.e. the file is opaque from the viewpoint of the file system. The internal structure and size of a file is defined by the application generating and using the file but is independent of the underlying physical storage system used to store the file. Access of user or applications to a file is granted by a file system via its file system interface providing services to create, use and manage files. These user or application oriented services are implemented via file system functionality which is referred to in this group as basic file system functionality, see the definitions below for subgroups [G06F 17/30091](#), [G06F 17/301](#) and [G06F 17/30115](#). In addition to this basic file system functionality many file system provide further functionalities, e.g. to reduce the consumption of resources, to improve the response time or to adapt the file system to individual user needs, see the definitions below for the subgroup [G06F 17/30129](#). File systems are used in many different environments and for different purposes. As a consequence different file system types have been evolved having different capabilities adapted to the specific requirements of the individual use scenarios; see the definitions below for the subgroup F8.
- Subgroups F2, F4 and F5 cover user related aspects of file systems of basic file system functionality, namely file storage and access structures, file search and file and folder operations. These aspects may be found in all types of file systems.
- Subgroup F7 covers aspects of further file system functionalities by extending the basic functionality of the file systems e.g. to personalise file systems, to reduce the response time or to minimise required resources such as storage space. These aspects may be found in many types of file systems.
- Subgroup F8 covers additional aspects of specific types of file systems. These aspects may be found only in one or few types of file systems.

Relationship between large subject matter areas

[G06F 17/30067](#) covers all aspects related to files where the internal structure and size of a file is independent of the underlying physical storage system used to store the file. This characteristic distinguishes this group from the technical field [G06F 3/0601](#) which covers all aspects of storing and managing data in physical storage systems where the used storage containers, e.g. volumes, LUNs, blocks, sectors, etc., depend on the individual physical storage system. Thus, [G06F 3/0601](#) covers the use of storage oriented or storage dependent data containers whereas [G06F 17/30067](#) covers the use of application oriented and storage independent data containers. In other words, files and directories provide a logical storage organisation on top of a physical storage layout.

References relevant to classification in this group

This subgroup does not cover:

Details of block level storage systems	G06F 3/0604
Details of error detection and correction	G06F 11/14

Informative references

Attention is drawn to the following places, which may be of interest for search:

Protecting data against unauthorised access or modification	G06F 21/00
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Special rules of classification within this group

The classification system of [G06F 17/30067](#) is organised in two dimensions. Subgroups F1 to F7 define different functional aspects of a standard file system. These functional aspects define the first dimension. The subgroup F8 defines additional aspects of different file system types. These file system types represent the second dimension. Double classification for functional aspects according to the first dimension and for additional aspects of different file system types according to the second dimension may be considered if a contribution in both dimensions is present.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Data backup	A copy of data created by replicating persistent data from a given storage medium (not from a volatile memory) at a particular point in time for the purpose of potentially later recovering said data in the state it was at said particular point in time. The recovery can either occur through restoration of said replicated data onto a storage medium or memory, or by using the memory/medium onto which the copy was created. A backup of data is typically used to at least partially correct or restore lost or corrupted data, although it is accepted that the restored state usually is not identical to the state when the data loss occurred, i.e. some data may be unrecoverable.
File	A file is an abstract data container used in file systems to manage a set of data. The internal structure of a file is normally not known by the file system, i.e. the file is opaque from the viewpoint of the file system. The internal structure and size of a file is defined by the application generating and using the file but is independent of the underlying physical storage system used to store the file.
File system	A file system (or filesystem) is a means to organize data expected to be retained after a program terminates by providing procedures to store, retrieve and update data.
HSM	A particular case of data migration wherein the target medium is lower in a hierarchical storage system, and is used for less frequently used data or for data that is no longer actively used. The target medium is suitable for longer term storage, is slower and has lower cost per unit of data. In contrast to backup, HSM systems do not provide an additional instance of the data.
Data migration	Moving data from one memory or storage medium to another without effectively replicating it since ultimately only one copy persists. Examples: transferring data from a disk to another one having different reliability, performance or cost properties.

Data replication	<p>The act of creating several instances of the same data of which at least two are available in the absence of errors and modifications of the original data. The different instances may be stored on different locations of a given storage medium or memory or they may be stored on physically distinct media or memories. The concept of replication is independent of the purpose it is used for. E.g. replication may be used for potential restoration of data, for load balancing and performance improvement, for fault tolerance, or for increasing the availability of data, etc.</p> <p>Data replication can occur at different levels of abstraction, e.g. at database level, at file system level, at the level of disk/storage I/O operations or at the level of (main) memory pages or even individual memory write instructions</p>
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G06F 17/30073

{Details of archiving (details of hierarchical storage management [HSM] systems [G06F 17/30221](#); lifecycle management in storage systems [G06F 3/0649](#); backup systems [G06F 11/1446](#))}

Definition statement

This subgroup covers:

Long-term storage or digital preservation of historical data object versions whereas the fact that files are stored in an archive is generally known to the user in contrast to Hierarchical Storage Management (HSM) systems in which the actual storage location is NOT known to the user. Whenever a file has been stored in the archive the original file in the file system will be deleted, normally to free storage space in the file system.

References relevant to classification in this group

This subgroup does not cover:

Lifecycle management in storage systems	G06F 3/0649
Backup systems	G06F 11/1446
Hierarchical storage management (HSM) systems	G06F 17/30221

G06F 17/30076

{Details of conversion of file system types or formats (management of the data involved in backup or backup restore [G06F 11/1448](#))}

Definition statement

This subgroup covers:

- Conversion of a file system from a first to a second type or format
- Upgrade from an older to a newer file system version or vice versa

References relevant to classification in this group

This subgroup does not cover:

File system format conversion of restoring backed up files	G06F 11/1448
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G06F 17/30079

{Details of migration of file systems (migration mechanisms in storage systems [G06F 3/0647](#))}

Definition statement

This subgroup covers:

Migration of complete file systems from a first to a second environment, e.g. for replacing old server systems.

References relevant to classification in this group

This subgroup does not cover:

Migration mechanisms in storage systems, e.g. volume migration	G06F 3/0647
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G06F 17/30082

{Use of management policies (file migration policies for HSM systems [G06F 17/30221](#); backup systems [G06F 11/1446](#))}

Definition statement

This subgroup covers:

- Policy-based management of file systems, e.g. In combination with archiving, allowing automatic management of file systems.
- Quota management.
- Allocation policies.

References relevant to classification in this group

This subgroup does not cover:

Backup policies	G06F 11/1446
File migration policies for HSM systems	G06F 17/30221

G06F 17/30085

{characterised by the use of retention policies (retention policies for HSM systems [G06F 17/30221](#))}

Definition statement

This subgroup covers:

Policy-based management of file systems characterised by the use of retention policies for managing the lifetime of files (lifecycle management of files).

References relevant to classification in this group

This subgroup does not cover:

Retention policies for HSM systems	G06F 17/30221
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G06F 17/30088

{Details of file system snapshots on the file-level, e.g. snapshot creation, administration, deletion (use of snapshots for error detection or correction [G06F 11/14](#), [G06F 11/16](#))}

Definition statement

This subgroup covers:

Management of snapshots of file systems, e.g. snapshot creation, deletion.

References relevant to classification in this group

This subgroup does not cover:

The use of snapshots for specific applications, e.g. backup or recovery should be classified in the application fields	G06F 11/14 , G06F 11/16
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G06F 17/30091

{File storage and access structures (management of files in storage systems [G06F 3/0643](#))}

Definition statement

This subgroup covers:

- File indexing methods used in file systems and their management, e.g. Using directories, trees (e.g. Comprising inodes, vnodes) for indexing and organising files in the file system.
- File indexing methods used in distributed file systems, e.g. The use of a centralised or distributed index in a distributed file system.

Informative references

Attention is drawn to the following places, which may be of interest for search:

management of files in storage systems	G06F 3/0643
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G06F 17/30094

{Distributed indices}

Definition statement

This subgroup covers:

Use of distributed indices in file systems, e.g., Distributed Hash Tables (DHT)

G06F 17/30097

{Hash-based (content-based indexing of textual data [G06F 17/30613](#))}

Definition statement

This subgroup covers:

Use of hashing or hash functions for indexing files in file systems wherein hashing values are calculated from the file content or file metadata, e.g. file name, file path, wherein the internal file structure or the data type of the file content is not relevant for the calculation of the hash-values.

References relevant to classification in this group

This subgroup does not cover:

Content-based indexing of textual data	G06F 17/30613
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G06F 17/301

{Details of searching files based on file metadata}

Definition statement

This subgroup covers:

Techniques and architectures for searching files in a file system based on file metadata, e.g. such as file name, associated keywords, time and owner information, creation date, file signatures or dependencies between files.

References relevant to classification in this group

This subgroup does not cover:

Content-based searching of multimedia data	G06F 17/30017
Content-based searching of image data	G06F 17/30244
Content-based searching of textual data	G06F 17/3061
Content-based searching of audio data	G06F 17/3074
Content-based searching of video data	G06F 17/30781
Content-based searching of HTML documents	G06F 17/30861

G06F 17/30103

{Query formulation}

Definition statement

This subgroup covers:

Specific techniques for generating file search queries.

G06F 17/30106

{File search processing}

Definition statement

This subgroup covers:

Techniques for processing search queries for files in a file system.

References relevant to classification in this group

This subgroup does not cover:

Specific techniques for processing search queries for files having specific contents, e.g. image files, audio files, video files, multimedia files, semi-structured files or text files. Such specific file search processing methods must be classified in the file type specific groups.

G06F 17/30109**{using file content signatures, e.g. hash values}****Definition statement***This subgroup covers:*

Techniques for searching files based on file content signatures such as hash values generated from the file content. The calculation of the file content signature does neither take into account internal structures of the file nor the data type of the file content.

Special rules of classification within this subclass/group

Specific methods for searching files having specific contents or data types, e.g. image files, audio files, video files, multimedia files, semi-structured files or text files. Such specific file search methods must be classified in the file type specific groups.

G06F 17/30112**{Query results presentation}****Definition statement***This subgroup covers:*

Specific methods for the presentation of file search/query results.

G06F 17/30115**{File and folder operations}****Definition statement***This subgroup covers:*

- Details of operations performed on files and folders, in particular at the user level, e.g. file copy, file delete(automatic) classification of files,
- Generation of file meta data, such as file names,
- Details of user-interfaces specifically adapted to file systems.

G06F 17/30117**{Delete operations (erasing in storage systems [G06F 3/0652](#))}****Definition statement***This subgroup covers:*

Erase or delete operations on files and folders, e.g. secure or efficient erase/delete.

References relevant to classification in this group

This subgroup does not cover:

Erasing in storage systems	G06F 3/0652
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G06F 17/3012

{File meta data generation}

Definition statement

This subgroup covers:

- Methods for generating metadata for files and folders.
- Methods for generating (content based) names of files and folders.

G06F 17/30123

{File name conversion (management of the data involved in backup or backup restore [G06F 11/1448](#))}

Definition statement

This subgroup covers:

Methods for converting file and folder names, e.g. for adapting the file names to different OS.

References relevant to classification in this group

This subgroup does not cover:

File name conversion of backed up files	G06F 11/1448
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G06F 17/30126

{Details of user interfaces specifically adapted to file systems, e.g. browsing and visualisation, 2d or 3d GUIs (query results presentation [G06F 17/30112](#); interaction techniques for graphical user interfaces [G06F 3/048](#))}

Definition statement

This subgroup covers:

Aspects of user-interfaces used for accessing or managing files and folders.

References relevant to classification in this group

This subgroup does not cover:

Generic interaction techniques for graphical user interfaces	G06F 3/048
Presentations of file search/query results	G06F 17/30112

G06F 17/30129

{Details of further file system functionalities}

Definition statement

This subgroup covers:

General optimisations which apply to more than one file system type, e.g. customisation, caching, prefetching, redundancy elimination, support for shared file access, synchronisation etc.

References relevant to classification in this group

This subgroup does not cover:

Specific optimisations which apply only to exactly one file system type	G06F 17/30182 .
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G06F 17/30132

{Caching or prefetching or hoarding of files (caching for data retrieval from the Internet [G06F 17/30902](#); caching for peripheral storage systems, e.g. disk cache [G06F 12/0866](#); network-specific arrangements or communication protocols for caching [H04L 67/2842](#))}

Definition statement

This subgroup covers:

- Details of using local or remote file caches, such as file caches in clients, servers or proxies,
- Details of using methods of prefetching or hoarding of remotely stored files, e.g. for supporting disconnected operations of mobile devices,
- File caching policies, e.g. selection of files to be cached.

Relationship between large subject matter areas

[G06F 17/30132](#) covers the application of caching in file systems, namely all aspects of using caches for caching files in file systems whereas [G06F 12/0866](#) covers all aspects and details of implementing caches in storage systems.

References relevant to classification in this group

This subgroup does not cover:

Caching for peripheral storage systems, e.g. disk cache; all aspects of caching, applied to file caching, which are not specific to files or file systems, e.g. details of cache management, caching architectures	G06F 12/0866
Caching used in the WWW for retrieving HTML pages	G06F 17/30902
Network-specific arrangements or communication protocols for caching	H04L 67/2842

G06F 17/30135

{Details of de-fragmentation performed by the file system (management of blocks in storage devices [G06F 3/064](#); saving storage space on storage systems [G06F 3/0608](#))}

Definition statement

This subgroup covers:

Details of file system defragmentation techniques where file system knowledge is used to reduce the number of file fragments stored on the underlying storage system. These techniques are typically performed by the file system so that the underlying storage system is not aware that a defragmentation operation is executed.

References relevant to classification in this group

This subgroup does not cover:

Saving storage space on storage systems	G06F 3/0608
Details of storage system defragmentation techniques performed by the underlying storage systems without using file system knowledge. The defragmentation is performed by the storage system but not by a file system. In particular management of blocks in storage devices is classified in	G06F 3/064

G06F 17/30138

{Details of free space management performed by the file system (management of blocks in storage devices [G06F 3/064](#); saving storage space on storage systems [G06F 3/0608](#))}

Definition statement

This subgroup covers:

Details of file system free space management where file system knowledge is used to manage the free space on the underlying storage system. These techniques are typically performed by the file system so that the underlying storage system is not aware that free space management is performed.

References relevant to classification in this group

This subgroup does not cover:

Saving storage space on storage systems	G06F 3/0608
Details of storage system free space management performed by the underlying storage systems without using file system knowledge. The free space management is performed by the storage system but not by a file system. In particular management of blocks is classified here.	G06F 3/064

G06F 17/30141

{Customisation support for file systems, e.g. localisation, multi-language support, personalisation}

Definition statement

This subgroup covers:

- Means and methods for the customisation of file systems.
- Support for localisation (multi-language support).
- Personalisation of the file system to users of the file system.

G06F 17/30144

{Details of monitoring file system events, e.g. by the use of hooks, filter drivers, logs}

Definition statement

This subgroup covers:

- Monitoring events, such as changes or updates to files or file- and file system metadata.

- Logging changes or updates to files or file- and file system metadata.

Special rules of classification within this group

If the techniques of monitoring file system events is used in a specific application domain, e.g. for synchronisation, indexing, backup, etc. classification in the specific application domain must also be considered.

G06F 17/30147

{for reducing power consumption or coping with limited storage space, e.g. in mobile devices (saving storage space on storage devices [G06F 3/0608](#); power saving in storage systems [G06F 3/0625](#))}

Definition statement

This subgroup covers:

- Specific adaptations of the filesystem to reduce the power consumption, e.g. In mobile devices,
- Specific adaptations of the filesystem for coping with limited storage space, e.g. By deleting (policy-based) selected files.

References relevant to classification in this group

This subgroup does not cover:

Saving storage space on storage devices	G06F 3/0608
Power saving in storage systems	G06F 3/0625

G06F 17/3015

{Redundancy elimination performed by the file system (management of the data involved in backup or backup restore using de-duplication of the data [G06F 11/1453](#))}

Definition statement

This subgroup covers:

Techniques for eliminating redundancies in file systems, e.g. by copy on write, sparse files, de-duplication.

References relevant to classification in this group

This subgroup does not cover:

Elimination of redundancy for the purpose of backup	G06F 11/1453
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G06F 17/30153

{using compression, e.g. sparse files (details of compression [H03M 7/30](#); protocols for data compression [H04L 69/04](#))}

Definition statement

This subgroup covers:

Elimination of redundancies in file systems by using compression methods, e.g. sparse files.

References relevant to classification in this group

This subgroup does not cover:

Details of compression	H03M 7/30
Protocols for data compression	H04L 69/04

G06F 17/30156

{De-duplication implemented within the file system, e.g. based on file segments (de-duplication techniques in storage systems for the management of data blocks [G06F 3/0641](#))}

Definition statement

This subgroup covers:

Elimination of redundancies in file systems by deduplication based on segments of a file in the case that the structure of the file is known. The individual segments of the file may have different lengths.

References relevant to classification in this group

This subgroup does not cover:

De-duplication techniques in storage systems for the management of data blocks	G06F 3/0641
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G06F 17/30159

{based on file chunks}

Definition statement

This subgroup covers:

Redundancies in file systems are eliminated by deduplication based on typically equally sized chunks of a file in the case that the structure of the file is unknown.

G06F 17/30162**{based on delta files}****Definition statement***This subgroup covers:*

Redundancies in file systems are eliminated by using delta-files, e.g. for storing multiple versions of files whereas only the modifications between subsequent versions of a file are stored in the delta-file.

G06F 17/30165**{Support for shared access to files, file-sharing support}****Definition statement***This subgroup covers:*

Techniques for supporting shared access to files, i.e. more than one application is allowed to access the same file.

G06F 17/30168**{Concurrency control, e.g. optimistic or pessimistic approaches}****Definition statement***This subgroup covers:*

File systems providing support for concurrency control to serialise access to files (pessimistic methods like locking) or provide for conflict resolution methods to resolve file system states where conflicting writes to a file have taken place (optimistic methods).

G06F 17/30171**{Locking methods, e.g. locking methods for file systems allowing shared and concurrent access to files}****Definition statement***This subgroup covers:*

Locking methods for file systems allowing shared and concurrent access to files.

G06F 17/30174

{Techniques for file synchronisation in file systems (change detection [G06F 17/30144](#); file management policies in general [G06F 17/30082](#); distributed file systems [G06F 17/30194](#); synchronisation of structured data [G06F 17/30575](#); protocols for data synchronisation between network nodes [H04L 67/1095](#))}

Definition statement

This subgroup covers:

- Details of synchronisation in file systems, e.g. synchronisation architectures, conflict resolution, administration of synchronisation by using synchronisation policies.
- Techniques for transparent or automatic synchronisation of files in file systems whereas no user interaction is necessary to perform the synchronisation, e.g. transparently keeping replicated file copies consistent with each other, e.g. by propagation of changes to all file replicas.

References relevant to classification in this group

This subgroup does not cover:

File management policies in general	G06F 17/30082
Change detection in file systems	G06F 17/30144
Distributed file systems	G06F 17/30194
Synchronisation of structured data	G06F 17/30575
Protocols for data synchronisation between network nodes	H04L 67/1095

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Synchronisation	Synchronisation is a service provided by file systems to synchronise two or more independent file systems or to synchronise replicas in a distributed file system.
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G06F 17/30176

{Details of non-transparently synchronising file systems}

Definition statement

This subgroup covers:

The non-transparent synchronisation of files in file systems whereas user interactions are necessary to perform the synchronisation, e.g. user-based file selection, conflict resolution with user support.

G06F 17/30179

{Details of file format conversion}

Definition statement

This subgroup covers:

Details of file format conversion during synchronisation, e.g. synchronisation between heterogeneous file systems.

G06F 17/30182

{File system types}

Definition statement

This subgroup covers:

Details of specific file system types which are specific to the individual file system types, e.g. details of file systems allowing only read-only access to files.

References relevant to classification in this group

This subgroup does not cover:

Generic aspects of file systems	G06F 17/30091 , G06F 17/301 , G06F 17/30115 , G06F 17/30129 , G06F 17/30182
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G06F 17/30185

{Append-only file systems, e.g. using logs or journals to store data}

Definition statement

This subgroup covers:

- File systems where data is only appended to existing data.
- Append-only file systems using logs to store data.

G06F 17/30188

{providing write once read many [WORM] semantics}

Definition statement

This subgroup covers:

File system of type WORM (Write Once Read Many), e.g. by using WORM hardware, by using standard hard disk extended by additional functionality implementing the WORM semantic.

G06F 17/30191

{Journaling file systems}

Definition statement

This subgroup covers:

File systems using journals to store files and file metadata.

G06F 17/30194

{Distributed file systems}

Definition statement

This subgroup covers:

Aspects of distributed file systems, e.g. architectures, specific management aspects.

G06F 17/30197

{implemented using NAS architecture (distributed or networked storage systems [G06F 3/067](#); protocols for distributed storage of data in a network [H04L 67/1097](#))}

Definition statement

This subgroup covers:

Systems and methods for storing files in a Network-Attached Storage system (NAS) which provides data access on the file level. The roles of the clients and the file server(s) are distributed over the network.

References relevant to classification in this group

This subgroup does not cover:

Distributed or networked storage systems which provides data access on the block level	G06F 3/067
Protocols for distributed storage of data in a network	H04L 67/1097

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

NAS	network attached storage
SAN	storage area networks

G06F 17/302

{Details of management specifically adapted to network area storage [NAS] (management of NAS or SAN [G06F 3/067](#))}

Definition statement

This subgroup covers:

Details of management of NAS, e.g. data placement policies of file or file fragments.

References relevant to classification in this group

This subgroup does not cover:

Management of SAN	G06F 3/067
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G06F 17/30203

{Details of providing network file services by network file servers, e.g. by using NFS, CIFS (network file access protocols [H04L 67/1097](#))}

Definition statement

This subgroup covers:

Details of providing network file services by Network-Attached Storage (NAS) file servers accessed over a network using file access protocols, e.g. by using Network File System (NFS) or Common Internet File System (CIFS) to access files.

References relevant to classification in this group

This subgroup does not cover:

Network file access protocols	H04L 67/1097
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G06F 17/30206

{implemented based on peer-to-peer networks, e.g. gnutella (p2p communication protocols [H04L 67/104](#))}

Definition statement

This subgroup covers:

File systems storing files in peer-to-peer like storage networks.

References relevant to classification in this group

This subgroup does not cover:

P2p communication protocols	H04L 67/104
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

File system peer	A file system peer implements both the file server and the client role. Thus, a peer may request in its client role a file from another peer. Additionally, the same peer may provide files in its file server role to other peers. Thus, both the client and the server role are distributed over the network.
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G06F 17/30209

{Details of management specifically adapted to peer-to-peer storage networks (topology management mechanisms of peer-to-peer networks [H04L 67/1042](#))}

Definition statement

This subgroup covers:

Details of file management specifically adapted to peer-to-peer like storage networks , e.g. data placement of file or file fragments.

References relevant to classification in this group

This subgroup does not cover:

Topology management mechanisms of peer-to-peer networks	H04L 67/1042
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G06F 17/30212

{implemented as replicated file system}

Definition statement

This subgroup covers:

Details of file systems replicating files on more than one storage place, e.g. a single file or even a complete file system is replicated.

References relevant to classification in this group

This subgroup does not cover:

Protocols for supporting replication or mirroring of data between network nodes	H04L 67/1095
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Replicated file	A replicated file is a copy of an original file and stored in a different storage place as the original file. The replicated file is kept consistent, i.e. synchronised, with the original file.
File replication	File replication is a service provided by the replicated file system whereas the fact that files are replicated is transparent to the users, such as applications, of the replicated file system.

G06F 17/30215

{Details of management specifically adapted to replicated file systems}

Definition statement

This subgroup covers:

Details of management of replicated file systems, e.g. data placement policies of file replicas.

G06F 17/30218

{specifically adapted to static storage, e.g. adapted to flash memory, SSD (dedicated interfaces to non-volatile semiconductor memory device [G06F 3/0679](#); dedicated interfaces to non-volatile semiconductor memory arrays [G06F 3/0688](#))}

Definition statement

This subgroup covers:

File systems specifically adapted to or used in flash memory, SSDs, etc. File system data structures or corresponding methods are adapted by taking constraints of the static storage into account.

References relevant to classification in this group

This subgroup does not cover:

Dedicated interfaces to non-volatile semiconductor memory device	G06F 3/0679
Dedicated interfaces to non-volatile semiconductor memory arrays	G06F 3/0688

G06F 17/30221

{Details of hierarchical storage management [HSM] systems, e.g. file migration and policies thereof (details of archiving [G06F 17/30073](#); life cycle management [G06F 3/0649](#); hybrid storage combining heterogeneous device types [G06F 3/0685](#))}

Definition statement

This subgroup covers:

Hierarchical storage management (HSM) used in file systems, e.g. lifecycle management, whereas the fact that files are stored on different levels of the HSM system is generally NOT known to the user in contrast to archive systems in which the actual storage location is known to the user. Further, in contrast to backup system only one copy of data objects exists. Whenever a

file has been migrated from one level to another level of the HSM system the file copy stored in the previous level of the HSM will be deleted, normally to free storage space in the HSM system.

References relevant to classification in this group

This subgroup does not cover:

Life cycle management in storage devices	G06F 3/0649
Hybrid storage combining heterogeneous device types	G06F 3/0685
Backup systems (in backup systems a second, backup copy is created from the original data without deleting the original data in the primary storage)	G06F 11/1446
Archive systems	G06F 17/30073

G06F 17/30224

{Parallel file systems, i.e. file systems supporting multiple processors}

Definition statement

This subgroup covers:

Details of parallel file systems, e.g. General Parallel File Systems (GPFS).

G06F 17/30227

{Transactional file systems (commit processing in structured data stores [G06F 17/30377](#))}

Definition statement

This subgroup covers:

File systems supporting transactional operations, e.g. commit processing, logging and recovery of file transactions, on file system objects (e.g. files, directories, etc.).

References relevant to classification in this group

This subgroup does not cover:

Commit processing in structured data stores	G06F 17/30377
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G06F 17/3023

{Versioning file systems, temporal file systems, e.g. file system supporting different historic versions of e.g. files}

Definition statement

This subgroup covers:

File system supporting different (historic) versions of e.g. files, directories, etc;

G06F 17/30233

{Virtual file systems}

Definition statement

This subgroup covers:

Virtual file systems where at least one file system component is virtualised, e.g. transparent access to compressed archives via a virtual file system e.g. DoubleSpace. Another example are virtual file systems implemented by database systems. Thus, file system requests are transparently translated into database queries.

G06F 17/30235

{Implementing virtual folder structures}

Definition statement

This subgroup covers:

Virtual file systems with virtual folders or a virtual folder structure.

G06F 17/30238

{Specific adaptations of the file system to access devices and non-file objects via standard file system access operations, e.g. pseudo file systems (dedicated interfaces to storage systems [G06F 3/0601](#))}

Definition statement

This subgroup covers:

Details of the file system for accessing devices and non-file objects, e.g. accessing CPU state information, using the standard file system access operations provided by a file system-like interface, e.g. the procfs, sysfs, usbfs, devpts or BSDs kernfs. From an application point of view the devices and non-file objects are accessed as virtual files.

References relevant to classification in this group

This subgroup does not cover:

Dedicated interfaces to storage systems	G06F 3/0601
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G06F 17/30241

{in geographical information databases (instruments for geographical navigation [G01C 21/00](#); three dimensional geographic models [G06T 17/05](#))}

Definition statement

This subgroup covers:

Data structures and retrieval of geographical or spatial information, e.g. digital maps.

References relevant to classification in this group

This subgroup does not cover:

Geographical navigation systems, route searching	G01C 21/20
Retrieval, searching and output of Points Of Interest (POI) information	G01C 21/3679
Location-dependent Internet search services	G06F 17/3087

Informative references

Attention is drawn to the following places, which may be of interest for search:

instruments for geographical navigation	G01C 21/00
three dimensional geographic models	G06T 17/05

G06F 17/30244

{in image databases}

Definition statement

This subgroup covers:

Systems and methods for retrieving digital still images in databases, or related to how metadata of the image type is used to retrieve other information, possibly of a different type.

References relevant to classification in this group

This subgroup does not cover:

Pattern recognition; low-level feature extraction per se	G06K 9/00
Image analysis, e.g. from bit-mapped to non bit-mapped	G06T 7/00

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated into a larger system:

Medical picture archiving (PACS)	G06F 19/321
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Digital picture intermediate information storage	H04N 1/21
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G06F 17/30247

{based on features automatically derived from the image data (pattern recognition [G06K 9/00](#))}

Definition statement

This subgroup covers:

For image databases relying on feature information (previously indexed or obtained on-the-fly) derived from the image data by automatic image analysis.

Informative references

Attention is drawn to the following places, which may be of interest for search:

pattern recognition	G06K 9/00
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Special rules of classification within this group

General documents with overviews of different approaches of content-based image retrieval are only classified in this group. Also includes specific content-based approaches for which the sub-groups are not applicable.

G06F 17/3025**{using colour}****Definition statement***This subgroup covers:*

Where the information extracted by analysis is related to colours present in the image (e.g. histograms).

G06F 17/30253**{using extracted text}****Definition statement***This subgroup covers:*

Where text extracted from the still images, in opposition to text added from external sources or inputs, is used for retrieval.

References relevant to classification in this group*This subgroup does not cover:*

Optical Character Recognition (OCR) techniques	G06K 9/00
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G06F 17/30256**{using a combination of image content features}****Definition statement***This subgroup covers:*

Hybrid systems using more than a single image feature typically based on feature vectors.

Special rules of classification within this group

Double classification in the appropriate [G06F 17/30247](#) subgroup(s) is necessary when specific, not trivial details concerning how one or more of the intrinsic image features are used is disclosed.

G06F 17/30259

{using shape and object relationship}

Definition statement

This subgroup covers:

Where recognized shapes or spatial relationships between objects/blocks of the images is used for retrieval.

G06F 17/30262

{using texture}

Definition statement

This subgroup covers:

Where texture descriptors are used for the retrieval.

G06F 17/30265

{based on information manually generated or based on information not derived from the image data}

Definition statement

This subgroup covers:

For images indexed with information not derived from the intrinsic image data (in opposition to features derived from the image data by image analysis).

Examples of such information: dates, time, position, etc. if provided by automatic means, e.g. a GPS module in a digital camera.

Special rules of classification within this group

Systems which also use features automatically extracted from the images (content-based metadata) are doubly classified according to the [G06F 17/30247](#) scheme.

G06F 17/30268

{using information manually generated, e.g. tags, keywords, comments, manually generated location and time information}

Definition statement

This subgroup covers:

For images indexed with manually generated information.

Examples of such information: authors, dates, time, position, keywords, ratings, comments, tags etc.

G06F 17/30271

{the images having vectorial formats}

Definition statement

This subgroup covers:

Vectorial images are typically used in CAD oriented databases.

Images can also be retrieved according to colours, shapes, etc. but the data structures are completely different as are the techniques of indexing/querying.

G06F 17/30274

{by browsing}

Definition statement

This subgroup covers:

Methods and systems where no indexing information is available for search, like in file systems, digital camera memories or digital photo albums, and where the retrieval is performed through arbitrary or guided browsing.

This subgroup covers also the browsing of (possibly many) results of a query.

G06F 17/30277

{by graphical querying}

Definition statement

This subgroup covers:

Essentially query interfaces, i.e. facilities to help the user in specifying a graphical query, e.g. drawings, sketches.

G06F 17/3028

{data organisation and access thereof}

Definition statement

This subgroup covers:

Data structures for images or image database organisation.

Includes aspects of accessing the images in the database to deal with bandwidth problems on the network or the computer, typically using caching or image interleaving.

G06F 17/30286

{in structured data stores}

Definition statement

This subgroup covers:

- Structured data stores comprise all sorts of database management systems based on a particular structured data model such as hierarchical, network (CODASYL), relational, object-relational, object oriented, deductive, and semantic, entity based systems.
- Structured data in general means that the data has a certain predetermined structure, which is typically the same for a set of managed / stored objects. For example, a set of data records which conform to a certain schema, i.e. the records have a particular number of fields of a certain data type. A schema need not be described explicitly in a document.
- A database system can be implemented on top of a file system, i.e. the records might be simply stored in files. Another indication for structured data could be a sophisticated declarative query / data manipulation language. This criterion should be used when no information about the data type or the storage technology used is available.

References relevant to classification in this group

This subgroup does not cover:

Unstructured data being binary data types such as image or audio data, which have merely a bit string structure (binary objects, files) or text documents including documents with mark-up such as HTML. Unstructured data is classified according to the respective data type (audio, image, video, multimedia, web, file systems). For semi-structured data, in particular XML, see [G06F 17/30908](#).

G06F 17/30289

{Database design, administration or maintenance}

Definition statement

This subgroup covers:

Aspects of defining and managing database models and systems at the logical or external levels, above the physical storage. The group is concerned only with aspects of managing a single database system. Details of tools, functions or services used to support a database administrator including data maintenance activities to support front-end applications.

References relevant to classification in this group

This subgroup does not cover:

Database storage and indexing details	G06F 17/30312
Data updating	G06F 17/30345
Data retrieval	G06F 17/30386

G06F 17/30292

{Schema design and management}

Definition statement

This subgroup covers:

Covers systems which support the creation and maintenance of data dictionaries in database systems. Details for mappings between schemas, where the mapping solution is independent of the application.

References relevant to classification in this group

This subgroup does not cover:

Uses of mappings between schemas in the relevant application group, e.g. object relational mappers and translation layers in client/server interfaces	G06F 17/3056
Abstract models in federated databases systems	G06F 17/30566
Replication and update of data dictionaries in distributed database systems	G06F 17/30575

G06F 17/30294

{with details for data modelling support}

Definition statement

This subgroup covers:

Support for users to interactively model data dictionaries or conversions from other data models into the data model supported by the DBMS.

G06F 17/30297**{with details for schema evolution support}****Definition statement***This subgroup covers:*

Facilities that allow the data dictionary of a database to be changed and support the continued operation of the database applications or of other interfacing systems.

G06F 17/303**{Database migration support}****Definition statement***This subgroup covers:*

Facilities to allow a database to be migrated between two different DBMS or between different versions of the same DBMS.

G06F 17/30303**{Improving data quality; Data cleansing}****Definition statement***This subgroup covers:*

Facilities that promote improvements to the quality of existing data of a database.

References relevant to classification in this group*This subgroup does not cover:*

Support for consistency and integrity of data during update operations	G06F 17/30371
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G06F 17/30306**{Database tuning ([G06F 17/30339](#) takes precedence; database performance monitoring [G06F 11/3409](#))}****Definition statement***This subgroup covers:*

Facilities to support the administration of the database operation, i.e. database tuning, not covered by specific storage tuning [G06F 17/30339](#) .

References relevant to classification in this group

This subgroup does not cover:

Storage tuning including database reorganisation	G06F 17/30339
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Informative references

Attention is drawn to the following places, which may be of interest for search:

database performance monitoring	G06F 11/3409
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G06F 17/30309

{Managing data history or versioning (querying temporal data [G06F 17/30551](#); querying versioned data [G06F 17/30548](#))}

Definition statement

This subgroup covers:

Support in a database system to keep the history of changes of records.

References relevant to classification in this group

This subgroup does not cover:

Multi-version concurrency control	G06F 17/30359
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Informative references

Attention is drawn to the following places, which may be of interest for search:

querying temporal data	G06F 17/30551
querying versioned data	G06F 17/30548

G06F 17/30312

{Storage and indexing structures; Management thereof}

Definition statement

This subgroup covers:

This the head group for details of how structured data is stored and maintained at the physical level including indexing in structured data

An index of a relational database is updated periodically.

G06F 17/30315**{Column-oriented storage; Management thereof}****Definition statement***This subgroup covers:*

Details to support databases with storage oriented by columns.

G06F 17/30318**{Details of Large Object storage; Management thereof}****Definition statement***This subgroup covers:*

Details of storing and interfacing with Large Objects in databases, e.g., Binary Large Objects (BLOBs).

G06F 17/30321**{Indexing structures (indexing structures for unstructured textual data
[G06F 17/30619](#))}****Definition statement***This subgroup covers:*

This is the parent group of the indexing branch for relational databases in the classification tree. Documents in this group disclose the creation and/or assembly of index structures.

References relevant to classification in this group*This subgroup does not cover:*

Indexing structures for textual data	G06F 17/30619
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G06F 17/30324**{Vectors, bitmaps or matrices}****Definition statement***This subgroup covers:*

Bitmap indices and other array oriented indexing structures.

G06F 17/30327**{Trees, e.g. B+trees}****Definition statement***This subgroup covers:*

This group consist of documents disclosing hierarchical indexes.

Facets: New data entries are merged into a hierarchical index.

G06F 17/3033**{Hash tables}****Definition statement***This subgroup covers:*

Details of hash table implementations used for indexing in databases.

G06F 17/30333**{Multidimensional index structures}****Definition statement***This subgroup covers:*

Any kinds of multidimensional indexes for database systems belong in this group. Double classification with the further groups in [G06F 17/30321](#) should be done when needed.

Dimensionality reduction is used for index generation of a multidimensional database.

G06F 17/30336**{indexing structure managing details}****Definition statement***This subgroup covers:*

This class comprises documents focusing on the automatic or manual management of an already existing index. This only comprises the organization and not the modification or updating of index entries: this means that normal adjustments of the index as a consequence of an update operation in a DB (insert, delete, update) are not classified here, but reorganizations of the index (e.g. as consequence of degradation due to many updates in the database) are.

Facets: The amount of clustering of an index in a relational database in analysed in order to optimise the index.

G06F 17/30339

{Tablespace storage structures; Management thereof}

Definition statement

This subgroup covers:

Aspects of storing and managing tablespace structures in secondary memory, including partitioning of tables over multiple storage areas, e.g., disks, and reorganisation of databases.

G06F 17/30342

{Details of User-Defined Types; Storage management thereof}

Definition statement

This subgroup covers:

Support for user defined types or abstract data types.

G06F 17/30345

{Update requests}

Definition statement

This subgroup covers:

Head group for dealing with update requests to modify records in a database made by users or front-end applications.

G06F 17/30348

{Concurrency control (transaction processing [G06F 9/466](#))}

References relevant to classification in this group

This subgroup does not cover:

Concurrency control in file systems	G06F 17/30067
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Informative references

Attention is drawn to the following places, which may be of interest for search:

transaction processing	G06F 9/466
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G06F 17/30351**{Optimistic concurrency control}****Definition statement***This subgroup covers:*

Optimistic approaches for concurrency control, i.e. conflicting accesses are not prevented but resolved later.

G06F 17/30353**{using timestamps}****Definition statement***This subgroup covers:*

Timestamp based concurrency schemes.

G06F 17/30356**{using versioning}****Definition statement***This subgroup covers:*

Version based concurrency schemes.

G06F 17/30359**{Pessimistic concurrency control approaches, e.g. locking, multiple versions without time stamps}****Definition statement***This subgroup covers:*

Pessimistic approaches (avoiding conflicts) for concurrency control, e.g. locking, multiple versions without time stamps, others.

References relevant to classification in this group*This subgroup does not cover:*

Locking methods	G06F 17/30362
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G06F 17/30362

{Locking methods, e.g. distributed locking, locking implementation details}

Definition statement

This subgroup covers:

Locking methods for concurrency control, e.g. multi-granularity/hierarchical/range locking, lock escalation, preclaiming of locks/consistency levels/predicate locks, distributed locking, locking implementation details, e.g. locking table.

G06F 17/30365

{Update request formulation}

Definition statement

This subgroup covers:

Facilitating the definition of requests for updating data.

G06F 17/30368

{Change logging, detection, and notification (replication [G06F 17/30575](#))}

Definition statement

This subgroup covers:

Details of implementing logging of database update operations. Detecting change for the purpose of notifying users or other systems.

References relevant to classification in this group

This subgroup does not cover:

Use of logging for replication or synchronisation	G06F 17/30575
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G06F 17/30371

{Ensuring data consistency and integrity}

Definition statement

This subgroup covers:

Ensuring database consistency and other ACID (Atomicity, Consistency, Isolation, Durability) properties. Use of triggers and stored procedures to support update operations and related impact in the database.

G06F 17/30374

{Details of updates performed during offline database operations}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Online updates	G06F 17/30377
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G06F 17/30377

{Details of updates performed during online database operations; commit processing}

Definition statement

This subgroup covers:

Handling record operations for inserts, edit, deletion, and undo. The operations occur on an individual basis, on batches or in the context of transaction processing.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Aspects of transaction processing regarding CPU programming	G06F 9/466
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G06F 17/3038

{Details of bulk updating operations (data conversion details [G06F 17/30569](#))}

Definition statement

This subgroup covers:

Handling bulk updates during operation of the database, e.g., to minimise impact on the performance for users.

Informative references

Attention is drawn to the following places, which may be of interest for search:

data conversion details	G06F 17/30569
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G06F 17/30383**{Updating materialised views}****Definition statement***This subgroup covers:*

Aspects of ensuring that materialised views, or persistent queries, are kept up to date during update operations.

References relevant to classification in this group*This subgroup does not cover:*

Query processing	G06F 17/30424
Use of materialised views for optimisation	G06F 17/30457

G06F 17/30386**{Retrieval requests}****Definition statement***This subgroup covers:*

Headgroup related to processing retrieval requests, i.e. finding records matching a query.

Informative references*Attention is drawn to the following places, which may be of interest for search:*

Query optimization for distributed queries	G06F17/30S4P3D
Plan operators for distributed queries such as join-algorithms adapted to distributed query processing	G06F 17/30483
Caching (including caching in Client/Server database systems): for database cache management	G06F 17/3048
for use of cached query results	G06F 17/30457

G06F 17/30389

{Query formulation (Interaction techniques for graphical user interfaces [G06F 3/048](#))}

Definition statement

This subgroup covers:

- All aspects of query formulation; textual, graphical, explicit or implicit formulation of database queries.
- User interfaces therefor (including help systems therefor).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Conversion of a query to an internal format	G06F 17/30427
Interaction techniques for graphical user interfaces	G06F 3/048

G06F 17/30392

{Interactive query statement specification based on a database schema}

Definition statement

This subgroup covers:

- Query wizards such as in MS access for constructing queries.
- Includes in particular query construction based on database schema or entity relationship diagram of database.
- Often the user can see the query statement, which allows the user to learn the syntax of the query language; also intelligent help systems for the formulation of queries (XP745694).

Further examples:

US5584024: a query assistant that permits the user to enter valid SQL queries; use of dialog boxes; see Fig. 2; see also WO03036519;

XP000022407: context sensitive help system for formulation of SQL queries; e.g. lists table names.

References relevant to classification in this group

This subgroup does not cover:

Interfaces for the formulation of natural language queries	G06F 17/30401
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G06F 17/30395

{Iterative querying; query formulation based on the results of a preceding query}

Definition statement

This subgroup covers:

This class is intended to cover all iterative approaches to querying; typically the user interacts with a display of the results of a preceding query in order to (re)formulate a new query; for example more restrictive query predicates might be formulated to narrow the focus of the query; may also include feedback on cardinality of qualifying result set.

G06F 17/30398

{Query predicate definition using graphical user interfaces, including menus and forms ([G06F 17/30392](#) takes precedence)}

Definition statement

This subgroup covers:

- Using graphical user interfaces (typically displaying charts, plots, images, maps, multi-media documents, or cubes etc.) to specify query predicates for attribute values; (hierarchical) menus and forms are used to specify query predicates for attributes e.g. CA2418754 or US2002087514;
- Menu entries are typically generated by querying database catalog or tables; also use of menus to select predefined queries, see WO03009090;
- A user normally does not see the resulting internal query statement;
- Includes also query-by-examples languages as developed by IBM where the user fills example values into a tabular scheme.

Examples:

Filling in exemplary table values e.g. the IBM QBE language; syntax checks therefor.

References relevant to classification in this group

This subgroup does not cover:

Graphical user interface is based on a visual database schema	G06F 17/30392
Iterative querying	G06F 17/30395

G06F 17/30401

{Natural language query formulation (natural language analysis, translation, semantics [G06F 17/27](#), [G06F 17/28](#))}

Definition statement

This subgroup covers:

A user formulates queries in natural language for querying structured data.

Informative references

Attention is drawn to the following places, which may be of interest for search:

natural language analysis, translation, semantics	G06F 17/27 , G06F 17/28
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G06F 17/30404

{Query languages}

Definition statement

This subgroup covers:

Describes which features a query language offers to express features; e.g. SQL features;

References relevant to classification in this group

This subgroup does not cover:

Optimisation aspects	G06F 17/30442
Implementation aspects	G06F 17/30477

G06F 17/30407

{Active constructs}

Definition statement

This subgroup covers:

Active constructs, e.g. constraints; triggers; Event-condition-action rules;

References relevant to classification in this group

This subgroup does not cover:

Implementation aspects	G06F 17/3051
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G06F 17/3041

{Embedded query languages}

Definition statement

This subgroup covers:

Embedded query languages, e.g. embedded SQL; data communication structures for cursors, etc.

G06F 17/30412

{Grouping and aggregation}

Definition statement

This subgroup covers:

Grouping and aggregation, e.g. GROUP-BY (and Having), SUM, MIN, STDDEV, Percentiles etc.

Examples:

XP002901286: Data Cube: A Relational Aggregation Operator Generalizing Group-By, Cross-Tab, and Sub Totals.

References relevant to classification in this group

This subgroup does not cover:

Implementation aspects	G06F 17/30489
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G06F 17/30415

{Stored procedures}

Definition statement

This subgroup covers:

Definition, processing and use of stored procedures.

G06F 17/30418

{Data retrieval commands; view definitions}

Definition statement

This subgroup covers:

Data retrieval commands and view definitions, e.g. in SQL, the command SELECT (including all features of select statements, unless there are particular classes for them) and VIEWS including view definitions.

G06F 17/30421

{for particular applications; for extensibility, e.g. user defined types}

Definition statement

This subgroup covers:

Query languages designed to support particular applications; commands for extensible query languages for adding user-defined/foreign functions etc.

G06F 17/30424

{Query processing}

Definition statement

This subgroup covers:

Query processing comprises all processing steps that need to be done in order to process a received formulated query:

parsing, translation, execution and delivery of the results (or an execution error);

G06F 17/30427

{Query translation}

Definition statement

This subgroup covers:

For all aspects of translating queries between clients (applications) and servers (data sources) see [G06F 17/30002](#) and [G06F 17/30283](#); for parsing see [G06F 8/427](#) .

G06F 17/3043

{Translation of natural language queries to structured queries (natural language analysis, translation, semantics [G06F 17/27](#), [G06F 17/28](#))}

Definition statement

This subgroup covers:

- Concerns in particular the translation of the expression in user natural language, e.g. spoken language, of the information to be retrieved, into database queries, e.g. the mapping from natural language (e.g. English) to SQL;
- question/answering systems;
- NOT general aspects of natural language processing.

Informative references

Attention is drawn to the following places, which may be of interest for search:

natural language analysis, translation, and semantics	G06F 17/27 , G06F 17/28
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G06F 17/30433

{Access plan code generation and invalidation; reuse of access plans}

Definition statement

This subgroup covers:

- Generation of code for given access plan;
- Invalidation of access plans when database objects / indexes etc. are dropped.

G06F 17/30436

{Internal representations for queries}

Definition statement

This subgroup covers:

Translations into an internal format such as query graph models, algebra, parse trees.

Examples:

XP000097925: Generating parse trees.

G06F 17/30439

{Standardisation and Simplification}

Definition statement

This subgroup covers:

Standardisation (conjunctive/disjunctive normal form) & Simplification (general logical transformations .like De Morgan etc.); the standardisation and simplification steps could also be viewed as first simple query optimisation steps, but they have been put under query translation because these steps are often independent of the actual optimiser used; the technical aim is to provide a standardised input format for the query optimiser.

G06F 17/30442**{Query optimisation}****Definition statement***This subgroup covers:*

Includes rewriting and plan optimisation; also optimization of application programs by modifying code etc.

G06F 17/30445**{for parallel queries}****Definition statement***This subgroup covers:*

Optimization of queries for parallel database systems with respect to best use of parallel execution possibilities; double classification could be necessary: for example when the join order is optimised to enable bushy trees for parallel join processing and additional classification in [G06F 17/30466](#) is needed.

G06F 17/30448**{Query rewriting and transformation}****Definition statement***This subgroup covers:*

All kinds of transformations of the internal representation of the query: transformations (by means of rewriting rules) between different internal representations on a logical level (e.g. query graph model) and transformations from a logical representation to a physical representation having physical plan operators (i.e. hash join or index-nested-loops-join).

Describes all aspects of transforming a (rewritten) logical internal representation into a physical execution plan with concrete plan operators; involves typically selection of plan operators and their execution order based on estimated execution costs.

This class includes manual rewriting of query statement; includes also logical tests such as for deciding query containment (for query folding etc.) e.g. XP9768; rewriting one query into several queries.

G06F 17/30451**{of sub-queries or views}****Definition statement***This subgroup covers:*

For example, view integration and subquery decorrelation.

G06F 17/30454**{of operators}****Definition statement***This subgroup covers:*

Rules for restrictions, joins, group-bys, aggregations, sorting, etc.

G06F 17/30457**{to use cached/materialised query results}****Definition statement***This subgroup covers:*

Query folding where a query is mapped to existing results including partial mapping; special case: reuse of cached results of a particular query.

References relevant to classification in this group*This subgroup does not cover:*

Maintenance of materialised views(updating, replication)	G06F 17/30002
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Informative references*Attention is drawn to the following places, which may be of interest for search:*

Database cache management in general	G06F 17/3048
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G06F 17/3046

{Optimising common expressions}

Definition statement

This subgroup covers:

Common sub-tree recognition and optimisation; also for multi-query optimisation.

References relevant to classification in this group

This subgroup does not cover:

Query folding (mapping a query to cached results or materialized views)	G06F 17/30457
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G06F 17/30463

{Plan optimisation}

Definition statement

This subgroup covers:

- Enumeration algorithms for plan generation and search strategy;
- Selectivity and cost estimation including learning based techniques for these estimations.

References relevant to classification in this group

This subgroup does not cover:

Sampling/generation of statistics	G06F 17/30536
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G06F 17/30466

{Join order optimisation}

Definition statement

This subgroup covers:

Join enumeration algorithms for determining the join order, e.g. left deep plans vs. bushy plans etc.

G06F 17/30469

{Selectivity estimation or determination}

Definition statement

This subgroup covers:

Estimation of the selectivity of query predicates: e.g. estimating the selectivity of the predicate "AGE=40" on a table means estimating which percentage of the records in this table has the value 40 in attribute AGE; can also include other aspects of query cost estimation.

G06F 17/30471

{Optimisations to support specific applications; extensibility of optimisers}

Definition statement

This subgroup covers:

- Extensibility;
- particular query types, etc. optimizer hints;
- query modifications to implement security control (e.g. by adding predicates to a query according to a security policy in order to mask data).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Security	G06F 21/00
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G06F 17/30474

{Run-time optimisation}

Definition statement

This subgroup covers:

- Query optimisation at run time of the query;
- using execution time statistics for re-optimisation;
- progress estimation during query execution; etc.

G06F 17/30477**{Query execution}****Definition statement***This subgroup covers:*

- All aspects of the actual execution of a single query with a given query execution plan;
- Execution of multiple queries;
- Database hardware e.g. parallel database machines.

G06F 17/3048**{Database cache management}****Definition statement***This subgroup covers:*

- Cache management at the database server itself, at the client/workstation or at the application server.
- Cache management strategies such as cache granularity management;
- Semantic cache management.
- Determining what data to cache.

References relevant to classification in this group*This subgroup does not cover:*

Query optimisation exploiting the cache	G06F 17/30442
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G06F 17/30483**{of query operations}****Definition statement***This subgroup covers:*

Physical operators used to execute operators in a query execution plan; includes particular execution strategies such as returning only the top N rows or delayed delivery of full query results; includes non-standard query processing operations.

G06F 17/30486

{Unary operations; data partitioning operations}

Definition statement

This subgroup covers:

- Algorithms for unary operations (which have only one table/data stream as input) such as aggregations/groupings, sorts or scans.
- Data partitioning operators.
- Hash, random, range, window partitioning etc.
- Can also include (partial) replication.

G06F 17/30489

{Aggregation and duplicate elimination}

Definition statement

This subgroup covers:

For example, including algorithms implementing SQL clauses such as having, groupby, cube, rollup etc.

References relevant to classification in this group

This subgroup does not cover:

Corresponding query language aspects	G06F 17/30412
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G06F 17/30492

{Efficient disk access during query execution}

Definition statement

This subgroup covers:

Scan operators, index access.

G06F 17/30495

{Binary matching operations}

Definition statement

This subgroup covers:

All operators except joins which have two tables (data streams) as input such as: universal quantification; division; intersection; union.

References relevant to classification in this group

This subgroup does not cover:

Joins	G06F 17/30498
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G06F 17/30498

{Join operations}

Definition statement

This subgroup covers:

Algorithms for joins such as index nested loops join, sort merge join, hash join, etc.

G06F 17/30501

{Intermediate data storage techniques for performance improvement}

Definition statement

This subgroup covers:

Compression, bit vectors, surrogate processing, main memory algorithms, etc.

G06F 17/30504

{Pointer and reference processing operations}

Definition statement

This subgroup covers:

- Pointer-based join operations.
- Fast pointer derefering.
- Pointer swizzling.

Double classification under [G06F 17/30607](#) (OODBMS) should be considered.

G06F 17/30507

{Applying rules; deductive queries}

Definition statement

This subgroup covers:

- Rules including rule constructs in SQL and active databases;
- deductive databases in general e.g. datalog; fixpoint semantics; deductive database techniques in general.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Inference methods or devices	G06N 5/04
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G06F 17/3051

{Triggers and constraints}

Definition statement

This subgroup covers:

- Trigger and integrity constraints as commonly used in the context of relational or similar database systems; see e.g. in the 3rd version of the Structured Query Language, SQL3.
- Execution models for determining the correct execution order for multiple constraints/triggers which need to be executed.
- Semantical aspects such as relation to statement/transaction atomicity.

References relevant to classification in this subclass/group

This subgroup does not cover:

Query language aspects	G06F 17/30407
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G06F 17/30513

{Recursive queries}

Definition statement

This subgroup covers:

Operators for computing recursive queries, e.g. in the version of the Structured Query Language adhering to the 1999 standard, SQL1999.

G06F 17/30516

{Data stream processing; continuous queries}

Definition statement

This subgroup covers:

- Query processing for data streams: continuous queries over a data set; the queries are executed continuously over a database, which means that the query must be executed against newly inserted and updated data.

- Event subscription processing where the event filters (= subscription requests or profiles) are seen as continuous queries.

G06F 17/30522

{Query processing with adaptation to user needs}

Definition statement

This subgroup covers:

Based on user profiles; weighting of query attributes specifying preferences of users e.g. for ranking/relevance; user context (location, user's informational needs); learning aspects thereof.

G06F 17/30525

{using data annotations (user-defined metadata)}

Definition statement

This subgroup covers:

Users add meta-data / annotations to the data, which is added to the database; comprises also manual classifications of data contents.

G06F 17/30528

{using context}

Definition statement

This subgroup covers:

Using the context of a user or client application as query criteria; context can be diverse, e.g. user's mood or location.

G06F 17/3053

{using ranking}

Definition statement

This subgroup covers:

Sorted output of query results in order of relevance; can use weights etc to specify relevance. Using this relevance for ranking and cut-off of results after returning the top-N hits.

G06F 17/30533

{Other types of queries}

Special rules of classification within this subclass/group

Similarity queries for structured data could be classified in this class [G06F 17/30533](#) or for example in [G06F 17/30495](#) (binary matching operations, if the document concerns the implementation of the similarity matching); for sorted result output by relevance see [G06F 17/3053](#).

G06F 17/30536

{Approximate and statistical query processing}

Definition statement

This subgroup covers:

Approximate query processing is based on sampling or models or statistical techniques and creates a fast, but imprecise answer to a query; includes queries for generation of statistics about the database e.g. attribute value distributions; includes database sampling.

G06F 17/30539

{Query processing support for facilitating data mining operations in structured databases}

Definition statement

This subgroup covers:

Covers specific support for data mining such as database operators for that purpose or optimizations.

References relevant to classification in this group

This subgroup does not cover:

Clustering and classification of structured data in general	G06F 17/30598
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G06F 17/30542**{Fuzzy query processing}****Definition statement***This subgroup covers:*

Query processing based on fuzzy functions or imprecise query predicates.
 Text related search predicates (using phonetic searches etc) should be farther classified in the specific text class for this aspect.

G06F 17/30545**{Distributed queries}****Definition statement***This subgroup covers:*

- Mapping of queries for distribution transparency,
- Optimizing the execution order of the plan fragments (subqueries) which need to be executed at the various sites.

G06F 17/30548**{Querying sequence data, e.g. querying versioned data}****Definition statement***This subgroup covers:*

- Querying sequence data such as time sequences like e.g. stock price sequences, etc.; typically supports operations such as aggregations or window queries on the sequence data;
- Includes implementation techniques such as indexing and optimisation therefor;
- Includes also querying versioned data.

References relevant to classification in this group*This subgroup does not cover:*

Processing data streams	G06F 17/30516
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G06F 17/30551

{Querying temporal data}

Definition statement

This subgroup covers:

Querying specifically adapted to deal with temporal data such as T-SQL or bitemporal models; refers to points in absolute time (timestamps etc); real time processing in databases.

References relevant to classification in this group

This subgroup does not cover:

Uses of timestamps for internal purposes such as concurrency control	G06F 17/30353
Documents where time or date attributes are treated as ordinary attributes without specific support	G06F 17/30386
Time sequences which refer to a relative sequence of points in time	G06F 17/30548

G06F 17/30554

{Query result display and visualisation}

Definition statement

This subgroup covers:

- Display of the results of a query, e.g. in tabular form, with interface to modify display formats;
- Complex visualisations such as displaying results on a geographical map.

References relevant to classification in this group

This subgroup does not cover:

Browsing techniques (e.g. navigating in database)	G06F 17/30572
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Special rules of classification within this group

Generating/modifying the layout of business reports etc. is not classified in [G06F 17/30](#).

G06F 17/30557

{Details of integrating or interfacing systems involving at least one database management system}

Definition statement

This subgroup covers:

Interfaces between systems involving at least a database supporting ad-hoc interaction, systematic integration or some type of co-operation.

References relevant to classification in this group

This subgroup does not cover:

Organised distribution or systematic replication of data between databases or database systems	G06F 17/30575
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G06F 17/3056

{between a Database Management System and a front-end application}

Definition statement

This subgroup covers:

Solutions specific for the interfaces between clients and a database system.

G06F 17/30563

{Details for extract, transform and load [ETL] procedures, e.g. ETL data flows in data warehouses}

Definition statement

This subgroup covers:

Details for implementation of data workflows transferring data from a plurality of databases into a common data store, in particular, the Extract, Transform, Load (ETL) operations to create and maintain data warehouses.

G06F 17/30566

{in federated and virtual databases (distributed queries [G06F 17/30545](#))}

Definition statement

This subgroup covers:

Systems providing a data abstraction layer on top of a set of heterogeneous database systems to convey the concept of a single virtual database to the end users or client systems.

Informative references

Attention is drawn to the following places, which may be of interest for search:

distributed queries	G06F 17/30545
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G06F 17/30569

{Details of data format conversion from or to a database}

Definition statement

This subgroup covers:

- Specific details of exchanging data between database systems involving a conversion of the data.
- Export and import operations.

G06F 17/30572

{Visual data mining and browsing structured data}

Definition statement

This subgroup covers:

Visualisation of data sets from a database in order to allow a human observer to discover interesting data properties; the user does not formulate an explicit query as the precise query (what is interesting) is not known to the user; the meta data (schema information) can be used for an effective visualisation of attribute values; browsing a database; supports e.g. navigating between data items; browsing process is adapted to the specifics of a database: e.g. displaying database schema information for browsing.

Examples:

WO0120438: Organizing large (structured) data set by grouping to make it conveniently accessible on a small display device (fig. 1);

D. Keim: "Visual Data Mining: Problems and Applications";

WO0215049: Visualizing structured data (interactions between customers and merchants, associated with a time value), e.g. hits per hour on a web server (fig. 4);

References relevant to classification in this group

This subgroup does not cover:

Query formulation aspects	G06F 17/30389
Query result display	G06F 17/30554

G06F 17/30575

{Replication, distribution or synchronisation of data between databases or within a distributed database; Distributed database system architectures therefor}

Definition statement

This subgroup covers:

Systems which distribute or replicate data between themselves. Descriptions of architectures thereof. Details in relevant subgroups.

G06F 17/30578

{Details of asynchronous replication and data reconciliation}

Definition statement

This subgroup covers:

Implementation details of asynchronous replication and in particular for conciliation procedures.

G06F 17/30581

{Details of synchronous replication}

References relevant to classification in this group

This subgroup does not cover:

Concurrency control for distributed databases	G06F 17/30348
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G06F 17/30584

{Details of data partitioning, e.g. horizontal or vertical partitioning}

Definition statement

This subgroup covers:

Implementation details for data partitioning between databases which fully or partially distributed the data between themselves.

G06F 17/30587

{Details of specialised database models}

Definition statement

This subgroup covers:

Implementation details of specialised database models which are not already covered by subgroups [G06F 17/30289](#) to [G06F 17/30575](#).

Special rules of classification within this group

In general double classification in at least one of the functional subgroups [G06F 17/30289](#) to [G06F 17/30575](#) and one of the subgroups of [G06F 17/30587](#) should be considered.

G06F 17/30589

{Hierarchical databases, e.g. IMS, LDAP data stores, Lotus Notes}

Definition statement

This subgroup covers:

Implementation details of supporting the storage and management of hierarchical data.

G06F 17/30592

{Multi-dimensional databases and data warehouses, e.g. MOLAP, ROLAP}

Definition statement

This subgroup covers:

In this group documents are kept which disclose assembly or functionality of MDDB; double classification with regard to subgroups [G06F 17/30312](#), [G06F 17/30386](#), and [G06F 17/30572](#) should be considered.

G06F 17/30595

{Relational databases}

Definition statement

This subgroup covers:

Implementation details specific to relational databases not covered by any of the subgroups [G06F 17/30289](#) to [G06F 17/30575](#).

G06F 17/30598

{Clustering or classification (for textual data [G06F 17/30705](#))}

Definition statement

This subgroup covers:

This group consists of documents dealing with the clustering or classification of structured data. Classes / clusters may already exist or can be created during the classification / clustering process. Documents disclosing class / cluster management of classification or clustering systems can be also found in this group.

References relevant to classification in this group

This subgroup does not cover:

Documents about cluster or classifying of textual data	G06F 17/30713
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Informative references

Attention is drawn to the following places, which may be of interest for search:

for textual data	G06F 17/30705
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G06F 17/30601

{including cluster or class visualization or browsing (for textual data [G06F 17/30713](#))}

Definition statement

This subgroup covers:

Including cluster or class visualization or browsing. This class consists of documents disclosing the graphical presentation of clusters or classes as result of a clustering or classification process. Additional data can be displayed with the clusters or classes.

Clusters are graphically presented. When mouse is scrolled over them additional data about the clusters is displayed. (interactive cluster display device).

Informative references

Attention is drawn to the following places, which may be of interest for search:

for textual data	G06F 17/30713
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G06F 17/30604

{Entity relationship models}

Definition statement

This subgroup covers:

Implementation details specific to entity relationship models not covered by any of the subgroups [G06F 17/30289](#) to [G06F 17/30575](#).

Special rules of classification within this group

In general double classification in at least one of the functional subgroups [G06F 17/30289](#) to [G06F 17/30575](#) and subgroup [G06F 17/30604](#) should be considered.

G06F 17/30607

{Object oriented databases}

Definition statement

This subgroup covers:

Implementation details specific to object-oriented databases not covered by any of the subgroups [G06F 17/30289](#) to [G06F 17/30575](#).

Special rules of classification within this group

In general double classification in at least one of the functional subgroups [G06F 17/30289](#) to [G06F 17/30575](#) and subgroup [G06F 17/30607](#) should be considered.

G06F 17/3061

{of unstructured textual data (document management systems [G06F 17/30011](#))}

Definition statement

This subgroup covers:

Retrieval of (unstructured, raw data) text data in databases, and/or employing metadata of the text type for retrieving other information, possibly of a different type.

References relevant to classification in this group

This subgroup does not cover:

Text processing, parsing and translation of natural language	G06F 17/20 - G06F 17/289
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Document Management Systems	G06F 17/30011
Image retrieval using shape and object relationship, including layout-based retrieval of text documents	G06F 17/30259

Informative references

Attention is drawn to the following places, which may be of interest for search:

Retrieval from the internet, search engines	G06F 17/30861
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G06F 17/30613

{Indexing}

Definition statement

This subgroup covers:

This is the head group for indexing in text data.

Details about the creation or structure of an index. Documents disclosing the updating or maintenance of indexes also belong in this branch.

G06F 17/30616

{Selection or weighting of terms for indexing ([G06F 17/30663](#) takes precedence; for summarization [G06F 17/30719](#))}

Definition statement

This subgroup covers:

Extraction of strings from a text for indexing purposes. Documents belonging to this group also disclose the identification or extraction of important information (special words, regions, relations between words in the text, etc.) from text content using mathematical calculations or dictionaries. The weight value indicating the importance of the information may be attached to it.

Facets:

Automatically extracting information for annotating a document;

A text is stemmed, stop words are removed and the remaining words are weighted according to their frequency of occurrence;

Segmentation and topic identification of texts. Weight values may be used to express semantics;

Extracting relevant information for indexing from natural language texts by parsing the text into components and extracting elements of information from the respective components;

Transforming unstructured text into structured data (using criterion-value pairs, e.g. model, year, colour as criteria for text relating to automobiles);

Expansion of indexing terms, e.g. with synonyms or spelling variants;

References relevant to classification in this group

This subgroup does not cover:

Extraction or weighting of terms for query translation	G06F 17/30663
Extraction or weighting of terms for text summarization	G06F 17/30719

G06F 17/30619

{indexing structures (indexing structures for structured data stores
[G06F 17/30321](#))}

Definition statement

This subgroup covers:

This is the head group for details about the creation or structure of a physical index storing the information to be indexed together with a physical location.

References relevant to classification in this group

This subgroup does not cover:

Indexing structures for structured data	G06F 17/30321
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G06F 17/30622

{Inverted lists}

Special rules of classification within this subclass/group

Inverted lists are often used to index terms in a database. When these terms consist of text, these documents should be classified here and not in the [G06F 17/30312](#) (Database / building index) groups.

G06F 17/30625**{Trees}****Definition statement***This subgroup covers:*

Documents disclosing hierarchical indexes.

Facets: Character strings in a text are stored hierarchically as keywords in an index file.

G06F 17/30628**{Hash tables}****Definition statement***This subgroup covers:*

Implementation details of hash tables used for indexing textual documents.

G06F 17/30631**{Index managing details}****Definition statement***This subgroup covers:*

Documents focussing on the automatic or manual management of an already existing index. This only comprises the organization and not the modification or updating of index entries.

Facets:

- Compression of a text index
- Using a GUI to manage an index

G06F 17/3064**{using system suggestions ([G06F 17/30646](#) takes precedence)}****Definition statement***This subgroup covers:*

The system suggests e.g. suitable keywords, categories, etc. The user can decide whether to make use of these suggestions or not. Using (parts of) previous queries as suggestions for new queries.

Facets: System suggests search words from different pre-stored categories.

References relevant to classification in this group

This subgroup does not cover:

Query reformulation based on results of preceding query	G06F 17/30646
Dialogues to establish an executable query	G06F 17/30654
Automatic query expansion with no user interaction	G06F 17/30672
Reuse of stored results of previous queries	G06F 17/30693

G06F 17/30643

{using document space presentation or visualization, e.g. category, hierarchy or range presentation and selection}

Definition statement

This subgroup covers:

An interactive interface for formulating queries using a category hierarchy.

References relevant to classification in this group

This subgroup does not cover:

(Categorized) browsing without generating a query	G06F 17/30716
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G06F 17/30648

{using relevance feedback from the user, e.g. relevance feedback on documents, documents sets, document terms or passages}

Definition statement

This subgroup covers:

The user informs the system about the relevance (or non-relevance) of (some of) the results. This relevance information is used in reformulating the query.

- Facets:
- Explicit feedback by the user.
- Evaluating implicit feedback, e.g. click through data.
- Also covers pseudo-feedback (where no real relevance feedback from the user is received but the top-ranking documents are considered as being highly relevant).

G06F 17/30651

{using graphical result space presentation or visualisation}

Definition statement

This subgroup covers:

The user is supported by the system to iteratively refine or modify the query formulation based on a graphical display of the results.

Facets: Limiting the next query to certain documents by graphically selecting these documents in the result set (e.g. using a rectangle or lasso tool).

Example:

EP1400902: Text content: Making a standard keyword query and presenting the results in a 2D map by building feature vectors, mapping each information item to a point in the 2D map based on similarity. Choosing a query area in the 2D map, displaying the items belonging to the query area (figs. 7 and 8);

G06F 17/30654

{Natural language query formulation or dialogue systems}

Definition statement

This subgroup covers:

- A dialogue between the system and the user to establish an executable query.
- Covers also natural language question-answering systems wherein prefabricated answers are retrieved.

Relationship between large subject matter areas

Q&A systems constructing an answer by mining knowledge from e.g. a text corpus	G06N 5/00
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Character input using prediction techniques	G06F 3/0237
Suggesting modifications to executable queries	G06F 17/30646

G06F 17/30657**{Query processing}****Definition statement***This subgroup covers:*

General aspects of processing queries.

G06F 17/3066**{Query translation}****Definition statement***This subgroup covers:*

Pre-processing the query to make it (more) suitable for query execution; typically done internally with no user interaction.

References relevant to classification in this group*This subgroup does not cover:*

Modification of queries with user interaction	G06F 17/30637
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G06F 17/30663**{Selection or weighting of terms from queries, including natural language queries}****Definition statement***This subgroup covers:*

Identifying or extracting important information (for the purpose of querying) from an input (query) text or a query.

- Facets:
- Identifying keywords in a text (e.g. an SMS), a query is generated there from for retrieving a set of images illustrating the text
- Identifying (spoken) keywords in a phone conversation used for querying a knowledge base
- A user inputs a plurality of search terms, e.g. by copy and paste from a text. The system extracts the search terms that occur infrequently in the set of documents

References relevant to classification in this group*This subgroup does not cover:*

Feature extraction for indexing purposes	G06F 17/30616
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G06F 17/30666

{Syntactic pre-processing steps, e.g. stopword elimination, stemming (lexical analysis [G06F 17/277](#), [G06F 8/425](#))}

Definition statement

This subgroup covers:

Basic pre-processing steps like eliminating words useless for purposes of retrieval (stop word elimination) and reducing variants of the same root word to a common stem (Stemming).

Example: see Baeza - Yates: "Modern Information Retrieval" chapters 7.2.1-7.2.3

References relevant to classification in this group

This subgroup does not cover:

Lexical analysis	G06F9/45A
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G06F 17/30669

{Translation of the query language, e.g. Chinese to English (language translation [G06F 17/28](#))}

Definition statement

This subgroup covers:

Translating queries in the native language of the user (e.g. Chinese) to the query language of the respective search engine (e.g. English).

Translating English queries into Spanish equivalent for querying a Spanish index.

Informative references

Attention is drawn to the following places, which may be of interest for search:

language translation	G06F 17/28
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G06F 17/30672

{Query expansion}

Definition statement

This subgroup covers:

Automatically adding query terms to a given query/automatically reformulating the query.

Facets:

Query expansion/reformulation based on semantic information stored in thesauri and/or ontologies, use of synonyms/hypernyms/hyponyms for query expansion/reformulation.

Concept-based querying of a document database.

Expanding a query using different spelling variants of query terms.

A set of text documents is queried not only using the most recent user query but also using keywords extracted from the queries received since the last switch of query topic was detected.

References relevant to classification in this group

This subgroup does not cover:

Query expansion by the user based on system suggestions	G06F 17/3064
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G06F 17/30675

{Query execution ([G06F 17/30699](#) takes precedence)}

Definition statement

This subgroup covers:

This is the parent group for describing the different methods used to calculate the degree of similarity between two entities (typically documents) or an entity and a query. These methods are normally used to rank query results. In the parent group documents are kept which do not focus on how the calculation is done.

Facets:

Degree-of-similarity score is somehow calculated and reorganized into heap form to select highest score.

References relevant to classification in this group

This subgroup does not cover:

Query execution based on matching of textual data against a user profile	G06F 17/30699
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G06F 17/30678

{using boolean model}

Definition statement

This subgroup covers:

Documents in which similarity is calculated or estimated with boolean or extended boolean models.

G06F 17/30681

{using phonetics}

Definition statement

This subgroup covers:

Matching phoneme lattices of a query with phonemes of information annotated to the information to be retrieved.

G06F 17/30684

{using natural language analysis}

Definition statement

This subgroup covers:

Similarity is estimated based on the semantic meaning of the query and the semantic meaning of every sentence in a document collection. For this purpose the relation and associated sense of different parts of sentences (sub sentences, words or suffixes) to each other are analyzed.

In some documents the term "natural language query" is often used for queries which are not really natural language based but a simple enumeration of query words connected by a logical AND (e.g. Google queries).

Facets:

Similarity is calculated by creating and using a graph for every sentence where words are nodes and the relationship of the words is represented as links between the nodes.

Relationship between large subject matter areas

Q&A systems constructing an answer by mining knowledge from a text corpus:[G06N 5/00](#)

References relevant to classification in this group

This subgroup does not cover:

Q&A systems matching natural language queries to prefabricated answers	G06F 17/30654
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G06F 17/30687

{using probabilistic model}

Definition statement

This subgroup covers:

Ranking is done on the probability that a retrieved document really comprises what the user is looking for. The sum of the probability that the document is important and the probability that the document is not important has to be one.

Facets:

Two content vectors are given; the probability that the first content vector is relevant to the second content vector is estimated using distributions of words.

G06F 17/3069

{using vector based model}

Definition statement

This subgroup covers:

Documents are represented as content vectors in a vector space. Relevance of a query result is calculated by operations done in vector space.

Facets:

Feature vector of a document is created comprising content vector, size of the font, date of publication and name of author.

Document vectors are formed from word vectors and compared to a query vector.

Relationship between large subject matter areas

Feature vectors representing web pages including content vectors of the page should be double classified here and in the corresponding web group.

G06F 17/30693

{Reuse of stored results of previous queries (for formulation of new queries [G06F 17/30646](#))}

References relevant to classification in this group

This subgroup does not cover:

Use of previous queries for suggesting formulations of new queries	G06F 17/3064
Reformulation of queries based on results of previous queries	G06F 17/30646

G06F 17/30696

{Presentation or visualization of query results ([G06F 17/30651](#) takes precedence; browsing or visualization of document space [G06F 17/30716](#))}

Definition statement

This subgroup covers:

- Highlighting of search terms in the result set of a query.
- Visualizing the relevance of the query results showing the respective contribution of the individual query terms.

References relevant to classification in this group

This subgroup does not cover:

Presentation or visualization of query results integrated with query (re-)formulation	G06F 17/30651
Browsing or Visualization without relation to a query, e.g. simply visualizing a document or document space	G06F 17/30716

Informative references

Attention is drawn to the following places, which may be of interest for search:

Clustered display of query results	G06F 17/30713
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G06F 17/30699

{Filtering based on additional data, e.g. user or group profiles (filtering in web context [G06F 17/30867](#))}

Definition statement

This subgroup covers:

Filtering or Routing of textual data based on additional information (user profiles, preferences, etc.). The "user profile" could just as well be a learned set of abstract rules or an explicit query provided by the user.

Facets: Composing personalized online newspapers based on user interests.

References relevant to classification in this group

This subgroup does not cover:

Filtering based on user profile in web context	G06F 17/30867
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G06F 17/30702

{Profile generation, learning or modification}

Definition statement

This subgroup covers:

Documents dealing with the generation of the user profiles, either automatically or manually, and/or learning of the user preferences.

Facets: Different user profiles are analysed and compared to expand the profile of an individual user.

G06F 17/30705

{Clustering or classification (manual classification [G06F 17/30722](#))}

Definition statement

This subgroup covers:

Automatic content based text classification and clustering. Management of classes or clusters (GUI or machine based), overviews of different content based clustering or classification methodologies.

Facets: A GUI based system to create / modify the names of classes in an existing classification tree.

References relevant to classification in this group

This subgroup does not cover:

Manual classification of textual data	G06F 17/30722
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G06F 17/30707

{into predefined classes}

Definition statement

This subgroup covers:

Classification or clustering into predefined classes or clusters. The existing classes or clusters may not be changed.

Documents should also be classified in this group if they do not tell whether classes are created, modified or predefined.

- Facets:
- Books are classified by their genre.
- Patent documents are classified into a patent classification scheme.
- A system that reclassifies all documents in a classification tree because the class definitions were changed.

G06F 17/3071

{including class or cluster creation or modification}

Definition statement

This subgroup covers:

Creation or modification of classes or clusters during the clustering or classification process.

- Facets:
- Groups which become too big are divided by the system.
- If a document does not fit in any existing group and a new group is created for it.
- Clusters of words of a text are allocated.

G06F 17/30713**{including cluster or class visualization or browsing}****References relevant to classification in this group***This subgroup does not cover:*

Visualization of documents or document spaces without clustering	G06F 17/30716
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Informative references*Attention is drawn to the following places, which may be of interest for search:*

Visualization of query results, including e.g. in ranked clusters	G06F 17/30696
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G06F 17/30716**{Browsing or visualization}****Definition statement***This subgroup covers:*

Mechanisms using non textual data (e.g. graphical data) for the visualization of collections of text documents, single text documents and concepts of text documents. These mechanisms can be used for document browsing.

Facets:

- Highlighting important sentences in a text document.
- Creating a table of content of a text document which can be used for browsing (eBook).
- A calendar-based user interface for date-based browsing of electronically stored documents.

References relevant to classification in this group*This subgroup does not cover:*

Document space visualization for the purpose of query formulation	G06F 17/30643
Visualization of query results	G06F 17/30696
Visualization of clusters	G06F 17/30713
Document space presentation for browsing in web context	G06F 17/30873

G06F 17/30719

{Summarization for human users}

Definition statement

This subgroup covers:

Summarization of text content for presenting to a human user. Normally, important text fragments are extracted and presented to the user.

Facets:

- Summarization of text based on users focus.
- Summarization of a collection of related documents.

References relevant to classification in this group

This subgroup does not cover:

Extracting text features for indexing purposes	G06F 17/30616
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G06F 17/30722

{based on associated metadata or manual classification, e.g. bibliographic data}

Definition statement

This subgroup covers:

Techniques for usage of metadata for text retrieval. The metadata can be human generated or machine made and may also be extracted out of text content.

Facets:

- Manual classification systems (such as patent classification schemes) should be classified in this group.
- Covers all kinds of metadata, e.g. citations, barcodes, keywords, etc.
- Covers also generation of metadata.
- Keywords are extracted and stored as additional data.
- Searching a document in a library using descriptive information, e.g. author, document state, archiving status, etc.

References relevant to classification in this group

This subgroup does not cover:

Layout-based retrieval of text documents	G06F 17/30259
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Extraction of Metadata for indexing purposes	G06F 17/30616
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G06F 17/30725

{using identifiers, e.g. barcodes, RFIDs (for URLs [G06F 17/30879](#))}

References relevant to classification in this group

This subgroup does not cover:

Retrieval of web documents by barcodes etc., e.g. encoding the URL	G06F 17/30879
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Document management	G06F 17/30011
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G06F 17/30728

{using citations (hypermedia [G06F 17/30014](#))}

Definition statement

This subgroup covers:

Retrieval of documents where the bibliographic data (metadata) is a citation to other document or documents.

Facets:

- CiteSeer, where documents cited/citing can be retrieved following the citation chain.

References relevant to classification in this group

This subgroup does not cover:

Hypermedia, including creation/management of hyperlinks	G06F 17/30014
Details of hyperlinks in HTML documents	G06F 17/30882

G06F 17/30731**{Creation of semantic tools}****Definition statement***This subgroup covers:*

Documents dealing with the creation (NOT THE USE) of structures helping to understand the semantics of words.

G06F 17/30734**{Ontology}****Definition statement***This subgroup covers:*

Creation of Ontologies (concept/term networks, graphs, trees, etc.).

G06F 17/30737**{Thesaurus}****Definition statement***This subgroup covers:*

Creation of thesauri (dictionaries, synonym lists).

G06F 17/3074

{Audio data retrieval (retrieval of video data [G06F 17/30781](#); retrieval of multimedia data [G06F 17/30017](#); general determination or detection of speech characteristics [G10L 25/00](#); speech recognition [G10L 15/00](#); speaker recognition [G10L 17/00](#); electrophonic musical instruments [G10H](#); editing or indexing of data stored based on relative movement between record carrier and transducer [G11B 27/00](#))}

Definition statement*This subgroup covers:*

This subgroup covers the retrieval of audio data from audio databases, e.g. retrieval of songs, by using content features or bibliographical data associated with the audio data.

References relevant to classification in this group*This subgroup does not cover:*

Retrieval of general multimedia	G06F 17/30017
Retrieval of video data	G06F 17/30781

Electroponic musical instruments	G10H
General determination or detection of speech characteristics	G10L 25/00
Speech recognition	G10L 15/00
Speaker recognition	G10L 17/00
Editing or indexing of data stored based on relative movement between record carrier and transducer	G11B 27/00

G06F 17/30743

{using features automatically derived from the audio content, e.g. descriptors, fingerprints, signatures, MEP-cepstral coefficients, musical score, tempo (content oriented musical parameter indexing, e.g. tempo [G10H](#); determination or detection of speech characteristics [G10L 25/00](#); audio watermarking, e.g. by inserting fingerprints [G10L 19/018](#); indexing by using information signals detectable on the record carrier and recorded by the same method as the main recording [G11B 27/28](#))}

Definition statement

This subgroup covers:

Retrieval and/or indexing methods use features derived from the audio content. This subgroups covers the mere use of audio content features in the context of audio data retrieval.

References relevant to classification in this group

This subgroup does not cover:

Analysis and extraction of content specific audio features	G10H
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Informative references

Attention is drawn to the following places, which may be of interest for search:

determination or detection of speech characteristics	G10L11/00
audio watermarking, e.g. by inserting fingerprints	G10L 19/018
indexing by using information signals detectable on the record carrier and recorded by the same method as the main recording	G11B 27/28

G06F 17/30746

{using automatically derived transcript of audio data, e.g. lyrics (speech recognition [G10L 15/00](#))}

Definition statement

This subgroup covers:

Text data is used to retrieve audio content, e.g. text derived from speech or music, phonetic transcript, music scores (sheet music), etc.

Informative references

Attention is drawn to the following places, which may be of interest for search:

speech recognition	G10L 15/00
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G06F 17/30749

{using information manually generated or using information not derived from the audio data, e.g. title and artist information, time and location information, usage information, user ratings (programmed access in sequence to addressed parts of tracks of operating discs [G11B 27/105](#))}

Definition statement

This subgroup covers:

Where the retrieval and/or indexing method uses information not-derived from the audio data, e.g. automatically derived from the context (e.g. elapsed time, date of creation, geo-codes, geographical coordinates, etc.).

References relevant to classification in this group

This subgroup does not cover:

Metadata derived by content-analysis	G06F 17/30743
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Informative references

Attention is drawn to the following places, which may be of interest for search:

programed access in sequence to addressed parts of tracks of operating discs	G11B 27/105
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G06F 17/30752

{using information manually generated, e.g. tags, keywords, comments, title or artist information, time, location or usage information, user ratings}

Definition statement

This subgroup covers:

Where the retrieval and/or indexing method uses manually generated information, e.g. data created by humans and added to the audio data at a post-production phase by manual annotation/tagging, e.g. title, song writer, interpret, users' tags, comments or annotations etc.

G06F 17/30758

{Query by example, e.g. query by humming}

Definition statement

This subgroup covers:

Formulation of the query predicate as an existing/example audio content, e.g. query by humming, using a recorded piece of audio data as example.

G06F 17/30761

{Filtering; personalisation, e.g. querying making use of user profiles}

Definition statement

This subgroup covers:

- Filtering rules.
- Retrieval personalisation.
- Generation, learning, modification and use of user profiles.
- Monitoring of user activities for profile generation (in particular generation and use of reproduction/playback histories/logs).
- Relevance feedback.

G06F 17/30764

{by using biological or physiological data}

Definition statement

This subgroup covers:

Using biological or physiological metrics obtainable by monitoring the human body, (e.g. heart beat, pulse, body temperature, brain waves) or biometric

techniques (e.g. fingerprint, iris or retina, face, voice or gait recognition) in formulation or personalization of audio queries.

G06F 17/30766

{Administration of user profiles, e.g. generation, initialization, adaptation, distribution}

Definition statement

This subgroup covers:

Techniques for modelling the changing taste of a user over time including manual, semi-automatic or automatic initialization of user profiles, their maintenance and modification by monitoring the user's history of audio content selection, his history of interaction with the selected content, the management of the shared profile of a group of users, e.g. profile splitting, stereotyping.

G06F 17/30769

{Presentation of query results (menu, index or table of content presentation of record carriers [G11B 27/32](#), [G11B 27/34](#))}

Definition statement

This subgroup covers:

Where the contribution is present in the visual or acoustic presentation of the query results to the user.

Informative references

Attention is drawn to the following places, which may be of interest for search:

menu, index or table of content presentation of record carriers	G11B 27/32 , G11B 27/34
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G06F 17/30772

{making use of playlists}

Definition statement

This subgroup covers:

This subgroup covers all methods presenting the results of query for audio data in form of a list which defines an order between the audio data used during the replay of the audio data, e.g. methods or interfaces to create, modify and manage multimedia playlists.

Where the contribution is present in the visual or acoustic presentation of the query results to the user.

G06F 17/30775

{Browsing (generation of a list or set of audio data [G06F 17/30772](#); trick modes [G11B 27/005](#); browsing through audio recorded on operating discs [G11B 27/105](#))}

Definition statement

This subgroup covers:

Specific methods of browsing e.g. a list or a collection/database of song titles or images or icons representing audio data. Such lists or sets of audio data representations may be the results of a querying operation. However, the contribution is the browsing method.

References relevant to classification in this group

This subgroup does not cover:

The generation of the list or set of audio data	G06F 17/30769
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Informative references

Attention is drawn to the following places, which may be of interest for search:

generation of a list or set of audio data	G06F 17/30772
trick modes	G11B 27/005
browsing through audio recorded on operating discs	G11B 27/105

G06F 17/30781

{of video data (recognising patterns [G06K 9/00](#); image analysis [G06T 7/00](#); editing or indexing information signals on a record carrier in which information is recorded and accessed based on relative movement between record carrier and transducer [G11B 27/00](#); source coding or decoding of digital video signal [H04N 19/00](#); selective content distribution, e.g. interactive television, video on demand [H04N 21/00](#))}

Definition statement

This subgroup covers:

- Video retrieval using content features.
- Video retrieval using bibliographical data.
- Details or query formulation and query processing.
- Browsing videos and the internal structure of videos.

- Presenting video query results.
- Video database index structures and management thereof.

Video data model.

The structure of this group relies on the following data model of video. Video content is the originally produced data comprising:

- The visual data (video frames).
- Accompanying audio track(s).
- Original textual content (typically subtitles, which can be coded and stored/transmitted either in binary/visual format or in textual format). Whatever data is added to video later, e.g. at a post-production phase, is referred to as bibliographical data or metadata.

References relevant to classification in this group

This subgroup does not cover:

Retrieval of general multimedia	G06F 17/30017
Image retrieval	G06F 17/30244
Audio retrieval	G06F 17/3074
Recognising patterns	G06K 9/00
Image analysis	G06T 7/00
Editing or indexing of data stored based on relative movement between record carrier and transducer, e.g. video data	G11B 27/00
Source coding or decoding of digital video signal	H04N 19/00
Selective content distribution, e.g. interactive television, VOD (Video On Demand)	H04N 21/00

G06F 17/30784

{using features automatically derived from the video content, e.g. descriptors, fingerprints, signatures, genre (recognising video content [G06K 9/00711](#); extraction of features or characteristics for pattern recognition of the image [G06K 9/46](#))}

Definition statement

This subgroup covers:

The retrieval and/or indexing method uses features derived from the video content. This top-level group gathers documents having no contribution in anyone of the underlying subgroups, e.g. documents on retrieval using video signatures/fingerprints based on statistical/probabilistic methods or hashing algorithms.

References relevant to classification in this group

This subgroup does not cover:

Recognising video content	G06K 9/00711
Extraction of features or characteristics for pattern recognition of the image	G06K 9/46

G06F 17/30787

{using audio features (general determination or detection of speech characteristics [G10L 25/00](#); speech recognition [G10L 15/00](#); speaker recognition [G10L 17/00](#); contents oriented musical parameter indexing, e.g. tempo [G10H](#))}

Definition statement

This subgroup covers:

Using features of the audio track of the video content, e.g. where query predicate(s) are in audio format (e.g. query-by-speech, query-by-music) or where retrieval or indexing uses low-level audio features (e.g. using magnitude/energy analysis, using speaker recognition methods).

References relevant to classification in this group

This subgroup does not cover:

Contents oriented musical parameter indexing, e.g. tempo	G10H
General determination or detection of speech characteristics	G10L 25/00
Speech recognition	G10L 15/00
Speaker recognition	G10L 17/00

G06F 17/3079

{using objects detected or recognised in the video content (methods for image acquisition of a pattern to be recognized involving target detection [G06K 9/3241](#))}

Definition statement

This subgroup covers:

Where the feature used for retrieval or indexing is a detected or recognised object.

Informative references

Attention is drawn to the following places, which may be of interest for search:

methods for image acquisition of a pattern to be recognized involving target detection	G06K 9/3241
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G06F 17/30793

{the detected or recognised objects being people (face recognition [G06K 9/00221](#); human body recognition [G06K 9/00369](#); speaker recognition [G10L 17/00](#))}

Definition statement

This subgroup covers:

Where the features used for retrieval or indexing are detected or recognised people, e.g. faces.

References relevant to classification in this group

This subgroup does not cover:

Face recognition	G06K 9/00221
Human body recognition	G06K 9/00369
Speaker recognition	G10L 17/00

G06F 17/30796

{using original textual content or text extracted from visual content or transcript of audio data (extraction of overlay text [G06K 9/3266](#))}

Definition statement

This subgroup covers:

Using

- Textual content (part (3) of the video content according to the video data model - see note of [G06F 17/30781](#)), e.g. the original subtitles (closed captions) transmitted in textual-format as part of the video stream or
- Extracted text from the video frames or from binary visually-coded subtitles (closed captions) or
- Text derived from speech or music, phonetic transcript, music scores (sheet music), etc.

References relevant to classification in this group

This subgroup does not cover:

Extraction of overlay text	G06K 9/3266
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G06F 17/30799

{using low-level visual features of the video content (methods for preprocessing an image in order to extract features of a pattern to be recognized [G06K 9/46](#); image processing involving image features extraction in general [G06T](#))}

Definition statement

This subgroup covers:

Using low-level visual features extracted from the video content for video indexing and retrieval; examples of descriptors range from a single value or a histogram of a particular low-level feature to a complex/statistical descriptor based on one or more features, e.g. video signature/fingerprint; usage of particular low-level visual features should be classified in one or more of the subgroups.

References relevant to classification in this group

This subgroup does not cover:

Recognising video content	G06K 9/00711
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Informative references

Attention is drawn to the following places, which may be of interest for search:

methods for preprocessing an image in order to extract features of a pattern to be recognized	G06K 9/46
Image processing in general	G06T

G06F 17/30802

{using colour or luminescence (colour analysis on image data [G06T 7/408](#))}

Definition statement

This subgroup covers:

Using colour or luminescence as the low-level visual feature for querying.

References relevant to classification in this group

This subgroup does not cover:

Colour analysis	G06T 7/408
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G06F 17/30805

{using shape ([G06F 17/3079](#) takes precedence; segmentation or edge detection on image data [G06T 7/0079](#); analysis of geometric attributes on image data [G06T 7/60](#))}

Definition statement

This subgroup covers:

Using detected shape as the low-level visual feature(s) for querying, e.g. based on a detected sketched shape drawn by the user.

References relevant to classification in this group

This subgroup does not cover:

Using objects detected or recognised in the video content	G06F 17/3079
Segmentation or edge detection	G06T 7/0079
Analysis of geometric attributes	G06T 7/60

G06F 17/30808

{using texture ([G06F 17/3079](#) takes precedence; texture analysis on image data [G06T 7/401](#), [G06T 7/407](#))}

Definition statement

This subgroup covers:

Using texture as the low-level visual feature.

References relevant to classification in this group

This subgroup does not cover:

using objects detected or recognised in the video content	G06F 17/3079
Texture analysis	G06T 7/401 , G06T 7/407

G06F 17/30811

{using motion, e.g. object motion, camera motion (motion analysis on image data [G06T 7/20](#))}

Definition statement

This subgroup covers:

Using a motion feature, e.g. motion vector(s), as the low-level visual feature.

References relevant to classification in this group

This subgroup does not cover:

Motion analysis	G06T 7/20
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G06F 17/30814

{using domain-transform features, e.g. DCT, wavelet transform coefficients}

Definition statement

This subgroup covers:

Using features of a specific domain transform as the low-level visual features, e.g. wavelet or Discrete Cosine Transform (DCT) transform coefficients; this approach is often referred to as retrieval or indexing "in compressed domain".

G06F 17/30817

{using information manually generated or using information not derived from the video content, e.g. time and location information, usage information, user ratings}

Definition statement

This subgroup covers:

Retrieval based on information manually associated with the video content, as well as retrieval based on information not-derived from the video content, e.g. data automatically generated by the camera such as elapsed time, date of creation, geo-codes, geographical coordinates, etc.

References relevant to classification in this group

This subgroup does not cover:

Use of information derived by content-analysis	G06F 17/30784
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G06F 17/3082

{using information manually generated, e.g. tags, keywords, comments, title and artist information, manually generated time, location and usage information, user ratings}

Definition statement

This subgroup covers:

Where the retrieval and/or indexing method uses information not-derived from the video content, e.g. data created by humans and added to video at a post-production phase by manual annotation/tagging, e.g. title, author, director, actors' names, users' tags, comments, annotations, usage information, user ratings etc.

G06F 17/30823

{Query formulation and processing specifically adapted for the retrieval of video data}

Definition statement

This subgroup covers:

The contribution is in specific query formulation and processing aspects as defined in the subgroups.

G06F 17/30825

{Query by example, e.g. a complete video frame or video sequence (graphical querying [G06F 17/30831](#))}

Definition statement

This subgroup covers:

Formulation of the query predicate as an existing/example video content, e.g. a video sequence or its excerpt/clip; typically a content-based descriptor is computed from said example content during query processing; if there is contribution in the usage of a particular content feature or metadata, this should be classified under a relevant [G06F 17/30784](#) subgroup or under [G06F 17/30817](#), respectively; if there is a contribution in a particular content feature extraction, characterisation or analysis, this should be classified under the relevant [G06K 9/00](#) or [G06T 7/00](#) subgroup(s).

References relevant to classification in this group

This subgroup does not cover:

Graphical querying	G06F 17/30831
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G06F 17/30828

{Filtering and personalisation; User profiles}

Definition statement

This subgroup covers:

- Filtering rules.
- Retrieval personalisation.
- Generation, learning, modification and use of user profiles.
- Monitoring of user activities for profile generation (in particular generation and use of reproduction/playback histories/logs).
- Relevance feedback.
- Playlist-based retrieval and playlist generation.

References relevant to classification in this group

This subgroup does not cover:

Recommending movies involving learning viewer preferences	H04N 21/251 , H04N 21/466
Creating a personalised video channel	H04N 21/2668 , H04N 21/458
Monitoring the number of times a movie has been viewed	H04N 21/44204
Monitoring of user selections, e.g. selection of programs	H04N 21/44222

G06F 17/30831

{Graphical querying, e.g. query-by-region, query-by-sketch, query-by-trajectory, GUIs for designating a person/face/object as a query predicate (end-user interface involving hot spots associated with the video [H04N 21/4725](#); end-user interface for selecting a Region of Interest [H04N 21/4728](#))}

Definition statement

This subgroup covers:

Graphical user interfaces for specifying graphical query predicates interactively (a mere selection of an example video sequence as a query predicate shall be classified in [G06F 17/30825](#)).

References relevant to classification in this group

This subgroup does not cover:

Query by an example video sequence	G06F 17/30825
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End-user interface involving hot spots associated with the video	H04N 21/4725
End-user interface for selecting a Region of Interest	H04N 21/4728

G06F 17/30834

{Query language or query format}

Definition statement

This subgroup covers:

Query formulation using a specific query language or format of the query, e.g. SQL variants adapted for video or specific formats for expressing query parameters.

G06F 17/30837

{Query results presentation or summarisation specifically adapted for the retrieval of video data (end-user interface for requesting or interacting with video content, e.g. video on demand interface or electronic program guide [H04N 21/472](#))}

Definition statement

This subgroup covers:

This group should not be used for classification..

References relevant to classification in this group

This subgroup does not cover:

End-user interface for requesting or interacting with video content, e.g. VOD interface or Electronic Program Guide	H04N 21/472
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G06F 17/3084

{Presentation of query results ([G06F 17/30843](#) takes precedence; browsing a video collection [G06F 17/30849](#))}

Definition statement

This subgroup covers:

Where the contribution is in presentation of query results, in particular visual presentation methods/interfaces.

References relevant to classification in this group

This subgroup does not cover:

Browsing a video collection	G06F 17/30849
Presentation in form of a video summary	G06F 17/30843
Two dimensional image generation	G06T 11/00

G06F 17/30843

{Presentation in form of a video summary, e.g. the video summary being a video sequence, a composite still image or having synthesized frames}

Definition statement

This subgroup covers:

Video summarisation, also called video abstraction, which produces a shorter and/or more condensed version of the original video. E.g. video skimming produces a shorter video sequence at the output, typically comprising a subset of keyframes extracted from the original video or a subset of excerpts / sub-sequences of the original video. E.g. a composite still image (2-D or 3-D), called e.g. a video mosaic, storyboard, video poster or "movie bar", typically comprising re-sized key-frames extracted from the original video, arranged into the still image like a in a comic book or like stones in a mosaic. E.g. a video sequence comprises artificial (synthesized) frames, e.g. with an artificial (synthesized) view not existing in any of the single frames of the original video, with a stitched panorama showing a broader view and/or more motion than any single original frame or with a view having overlaid multiple instances of the same moving object.

References relevant to classification in this group

This subgroup does not cover:

Two dimensional image generation	G06T 11/00
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G06F 17/30846

{Browsing of video data (end-user interface for requesting or interacting with video content, e.g. video on demand interface or electronic program guide [H04N 21/472](#); indicating arrangements in the context of indexing and addressing recorded information [G11B 27/34](#))}

Definition statement

This subgroup covers:

- Browsing a plurality of video files/sequences in a video collection/database.
- Browsing the internal structure of a single video sequence.
- Systems and methods for hyperlinking in hypervideo.

Informative references

Attention is drawn to the following places, which may be of interest for search:

end-user interface for requesting or interacting with video content, e.g. video on demand interface or electronic program guide	H04N 21/472
indicating arrangements in the context of indexing and addressing recorded information	G11B 27/34

G06F 17/30849

{Browsing a collection of video files or sequences}

Definition statement

This subgroup covers:

Browsing a plurality of video files/sequences in a video collection/database, e.g. using thumbnails, (moving) icons, cover art, etc.

G06F 17/30852

{Browsing the internal structure of a single video sequence}

Definition statement

This subgroup covers:

Browsing the internal structure of a single video sequence, e.g. browsing by jumping between shots, scenes, objects or events in the content of the sequence.

G06F 17/30855

{Hypervideo (linking data to content, e.g. by linking an URL to a video object in the context of video distribution systems [H04N 21/858](#))}

Definition statement

This subgroup covers:

- Systems and methods for hyperlinking in hypervideo.
- Computed links, including dynamically determined anchor and targets of links.
- Management of annotations linked to other documents.

References relevant to classification in this group

This subgroup does not cover:

Linking data to content, e.g. by linking an URL to a video object in the context of video distribution systems	H04N 21/858
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G06F 17/30858

{Video database index structures or management thereof (table of contents on a record carrier [G11B 27/327](#))}

References relevant to classification in this group

This subgroup does not cover:

Indexing of audio and video or audiovisual data on record media	G11B 27/00
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Informative references

Attention is drawn to the following places, which may be of interest for search:

table of contents on a record carrier	G11B 27/327
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G06F 17/30861

{Retrieval from the Internet, e.g. browsers (internet protocol [H04L 29/06095](#))}

Definition statement

This subgroup covers:

- Systems and methods for browsing and retrieving information on Internet-like networks

- Aspects in subgroups deal with search engines specifics (e.g. Crawling, indexing, search personalisation), Web navigation, Web site management (e.g. Content collection, organization and management of web sites, publication of same) and browsing optimizations (e.g. For quicker access or adequate visualisation)

Relationship between large subject matter areas

Close relationship with [H04L 29/08](#) and [H04L 67/00](#), especially due to particulars in OSI model's level 7: application layer.

References relevant to classification in this group

This subgroup does not cover:

Web site advertisement	G06Q 30/00
Network protocol aspects	H04L 29/06 , H04L 29/08 , H04L 67/00
Routing of packets, address resolution in data networks	H04L 29/12009

Informative references

Attention is drawn to the following places, which may be of interest for search:

internet protocol	H04L 29/06095
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G06F 17/30864

{by querying, e.g. search engines or meta-search engines, crawling techniques, push systems}

Definition statement

This subgroup covers:

Systems and methods and systems to collect, organize or manage indexation information originating from more than one source in order to support keyword based searching.

The group addresses Web/Internet retrieval techniques dealing specifically with the nature of Internet: heterogeneity of data, users and devices, large number of documents and users, as well as with the lack of detailed knowledge of sources.

It covers facets such as:

- Crawling techniques to discover/navigate sites and document hyperlinks.

- Meta-search engines.
- Remote systems interactions on the internet for search purposes.
- Distributed and remote indexing of content on the internet.
- Handling documents in different languages.

References relevant to classification in this group

This subgroup does not cover:

Text content indexation	G06F 17/30613
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Special rules of classification within this group

Local, keyword-based search engines should be classified in the appropriate subgroups according to the retrieved type of data; for example, if dealing with: unstructured text, see [G06F 17/3061](#).

G06F 17/30867

{with filtering and personalisation}

Definition statement

This subgroup covers:

- Techniques to select the information conveyed to the user during his retrieval session, usually in complement to an explicit user query request,
- Personalisation of queries and/or of returned results.

Facets include:

- Censoring by filtering documents (e.g. By keyword or objectionable images).
- Using inclusive/exclusive lists of sites/pages to define viewable content.
- Sharing user profile knowledge or identifying common interests to identify relevant information.
- Systems using a single user profile to filter information or enhance query
- Aggregation of information (personalised on-line newspapers).
- User navigation monitoring to identify user interests and consequent query refinement.

References relevant to classification in this group

This subgroup does not cover:

Filtering pages containing malware, virus or phishing attempts	G06F 21/56 , H04L 29/06551
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Recommendation not directed at the retrieval of documents, but rather to items for sale, or "friends" (e.g. social matchmaking)	G06Q
Personalisation for targeted marketing or advertisement	G06Q 30/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

When censoring comprises modifying the content	G06F 17/30905
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G06F 17/3087

{Spatially dependent indexing and retrieval, e.g. location dependent results to queries}

Definition statement

This subgroup covers:

- Methods and systems where the client accessing a web site conveys somehow localization or temporal information that is then used to personalise queries and/or results.
- methods and systems where web content indexation involves localization information (spatial information).
- Integration of geographic (spatial) information in Web pages with other information.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Network protocols in which the network application is adapted for the location of the user terminal	H04L 29/08657
Messaging using geographical location information	H04L 51/20
Services or facilities specially adapted for wireless communication network making use of the locations of the users	H04W 4/02

G06F 17/30873

{by navigation, e.g. using categorized browsing, portals, synchronized browsing, visual networks of documents, virtual worlds or tours}

Definition statement

This subgroup covers:

- Interactive ways to help the user in recognising desired information in web sites/web pages.
- Methods and systems to help an interactive navigation within the document space on the web, in a search narrowing approach, including providing suggestions of pages to visit which appear relevant to the user's search path.
- Methods and systems whereby visual cues are typically provided to show existing relationships among documents or to provide a document space visualization.
- Passive browsing, guided tours, wherein a list of web pages to visit is prepared in advance or automatically devised

Examples: Methods can be based on a classification or clustering approach to organise the documents. It can also use a query to select a starting point for navigation, showing how the returned documents relate to each other. The yahoo portal is the classical example.

References relevant to classification in this group

This subgroup does not cover:

Document hyperlinking per se, computed links	G06F 17/30014
Returning a document set as a result of a query	G06F 17/30864

G06F 17/30876

{by using information identifiers, e.g. encoding URL in specific indicia, browsing history}

Definition statement

This subgroup covers:

Cases where the user already has an identifier for the information he wants to retrieve. Typically, the identifier is a product code or a bookmark. The general idea is that the user doesn't have to blindly search for the information.

G06F 17/30879**{by using bar codes}****Definition statement***This subgroup covers:*

- Use of a barcode readers (e.g. to read a UPC code or even a URL printed on a product) connected to a computer with a browser which fetches the relevant information on the Internet.
- Also systems wherein the user inputs the product code directly in a browser link field.

Facets:

- The code can be a direct URL or one which needs to be first resolved in an intermediary server.
- The code can further comprise commands, or information used for personalising the search.

References relevant to classification in this group*This subgroup does not cover:*

Details of bar codes and readers per se	G06K 19/00
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G06F 17/30882**{details of hyperlinks; management of linked annotations}****Definition statement***This subgroup covers:*

- Details of hyperlinking in hypertext.
- Computed links, including dynamically determined anchor and targets of links.
- Management of annotations linked to other hypertext.

References relevant to classification in this group*This subgroup does not cover:*

Navigation in hyperlinked Web environments	G06F 17/30873
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G06F 17/30884

{Bookmark management}

Definition statement

This subgroup covers:

- Methods and systems whereby the browser bookmarks are used to reference, organise, classify and access information.
- Local or central bookmark storage, managed by an individual or an organization.
- Related management functions such as: replace in bulk, share bookmarks, detect broken links, add comments for later reference, extract from files, enhance visual aspect (e.g. icons, colours for easier recognition), automatic extraction (from pages), classification, etc.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Bookmarks	represent information already identified as relevant for the user, they are user oriented and they represent information of interest already identified.
Portals	present a way for information yet to be discovered and they are not specific to a user.

G06F 17/30887

{URL specific, e.g. using aliases, detecting broken or misspelled links (address allocation to terminals or nodes connected to a network [H04L 29/12009](#))}

Definition statement

This subgroup covers:

- Variations of URLs in order to facilitate or simplify the access to the information (e.g. alias in non-Latin characters, tinyURLs).
- These URLs can refer to existing documents but also to virtual pages created at access-time or accessing transparently other links.

Informative references

Attention is drawn to the following places, which may be of interest for search:

address allocation to terminals or nodes connected to a network	H04L 29/12009
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Use of aliases or nicknames in arrangement for managing network naming	H04L 29/12594
Addressing or naming in networks with short addresses	H04L 29/12943

G06F 17/3089

{Web site content organization and management, e.g. publishing, automatic linking or maintaining pages}

Definition statement

This subgroup covers:

Organization and management of web sites: how data is collected, stored and organised in a server and how the information is published (e.g. dynamic web page servers), made available or sent to users

- Creation of site maps.
- Registration of sites/pages in search engines.
- Link organization and maintenance.
- Push channels, syndication and subscription systems.
- Web CMS (Content Management Systems) repositories.

References relevant to classification in this group

This subgroup does not cover:

Web page authoring	G06F 17/20
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

ASP	Active Server Page: Microsoft Tool for dynamically serving Web pages
JSP	Java Server Page: Java tools for dynamically serving Web pages

G06F 17/30893

{Access to data in other repository systems, e.g. legacy data or dynamic Web page generation}

Definition statement

This subgroup covers:

- Documents concerned with technologies to support the access to data in proprietary or legacy systems from the Internet.
- Systems and methods to translate, offline or on-the-fly, proprietary formats to the open standards of Internet.
- Dynamic page creation from legacy system.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Tree transformation in mark-up documents, XSLT	G06F 17/227
File format conversion	G06F 17/30005

G06F 17/30896

{Document structures and storage, e.g. HTML extensions}

Definition statement

This subgroup covers:

- The way documents are represented and their structures are used.
- Extensions to, or special uses of the HTML coding language.

Example of document illustrating extensions to the HTML language:
EP0820026.

G06F 17/30899

{Browsing optimisation}

Definition statement

This subgroup covers:

- Optimisations in the browsing process concerned with faster or simpler access to information.
- Improvements that enhance or simplify the understanding of data or the visualization of data on the user's device,

These include among others:

- Identifying changes in pages or sections of pages.
- Combined printing of web documents. E.g. Several web pages forming a single document.
- Combined access to cd-rom information with internet browsing.
- Using specific data viewers (e.g. Mime dependent).
- In general, improvements with the browsing process.

References relevant to classification in this group

This subgroup does not cover:

Voice browsers, e.g. interpreting VoiceXML, for providing telephonic information services	H04M 3/4938
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G06F 17/30902

{of access to content, e.g. by caching (accessing, addressing or allocating within memory systems and caches [G06F 12/08](#))}

Definition statement

This subgroup covers:

- Ways to speed up access to information on the Internet, typically, via caching and/or prefetching.
- Content dissemination systems.
- Look-ahead (Web) caching.
- Caching static and/or all of portions of dynamic data.
- Caching or hoarding of Web content on local removable storage (cdfs, DVDs, USB keys) for later browsing.

Relationship between large subject matter areas

Accessing, addressing or allocating within memory systems and caches	G06F 12/08
Network arrangements for storing temporarily data at an intermediate stage, e.g. caching	H04L 29/08801

Special rules of classification within this group

The type of caching referred to here usually occurs at an application level: it is content aware, meaning that the system has some knowledge about the data content, and will decide what and how to cache it on the basis of this content.

This is to oppose to system level caching, where the data content is transparent to the cache.

G06F 17/30905

{Optimising the visualization of content, e.g. distillation of HTML documents}

Definition statement

This subgroup covers:

- Methods and systems manipulating Web page content (e.g. HTML) for the purpose of changing the presentation of a page, in order to enhance the comprehension or visual rendering of its content.
- Adapting content for providing support to devices with various displays (e.g. PDA small screen).
- Reorganizing or simplifying the page layout.
- Using user profiles or templates to create or change the page presentation.

References relevant to classification in this group

This subgroup does not cover:

Web page authoring	G06F 17/20
Manipulation for advertisement or marketing purposes	G06Q 30/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Arrangements for conversion or adaptation of application content or format	H04L 29/08756
Protocols for network applications adapted for terminals or networks with limited resources and for terminal portability	H04L 29/08108
Message adaptation based on network or terminal capabilities	H04L 51/06

Special rules of classification within this group

While the manipulation of navigation items in a Web page (e.g. hyperlinks) to simplify browsing (for example associating a visible numerical code to links on a page, and allowing keying in the code instead of activating the link with a pointer device) pertains to this group, document navigation techniques themselves should be classified in [G06F 17/30873](#).

May also include simple cases of document summarisation (priority to [G06F 17/3061](#)) as long as the goal is page visualisation and not to be

used for the purpose of document indexation. Typically uses an HTML parser (for parsing techniques see [G06F 8/427](#)). For format conversions not presentation dependent or related, [G06F 17/30005](#) takes precedence. Content adaptation.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Distillation	Process of reducing the amount of information before delivery, in particular to eliminate information which cannot be rendered on the end device (colour on a black and white screen, or downscaling of images in a Web page for a small screen)
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G06F 17/30908

{of semistructured data, the underlying structure being taken into account, e.g. mark-up language structure data}

Definition statement

This subgroup covers:

This is the parent group of the groups handling semistructured data (SGML, XML, and HTML etc.).

References relevant to classification in this group

This subgroup does not cover:

Manipulating by use of codes, XML document transformation	G06F 17/22
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Web site document structures and storage, e.g. HTML extensions	G06F 17/30896
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G06F 17/30911**{Indexing, e.g. of XML tags}****Definition statement***This subgroup covers:*

Creation or maintenance of an Index comprising tag (structure) and content information which is used to retrieve information in semistructured documents.

G06F 17/30914**{Mapping or conversion}****Definition statement***This subgroup covers:*

Head class for documents disclosing mappings of semistructured documents to other structures.

G06F 17/30917**{Mapping to a database}****Definition statement***This subgroup covers:*

Semistructured documents are mapped to a database (relational, object oriented, etc.).

G06F 17/3092**{Mark-up to mark-up conversion (conversion for visualization in web browsing [G06F 17/30905](#))}****Definition statement***This subgroup covers:*

Semi-structured documents are normalized or converted into another semi-structured scheme.

Informative references*Attention is drawn to the following places, which may be of interest for search:*

Conversion for visualization in web browsing	G06F 17/30905
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G06F 17/30923**{XML native databases, structures and querying}****Definition statement***This subgroup covers:*

Assembly, generation and maintenance of semistructured (xml) databases as well as operations performed on semistructured (xml) databases. Querying of said databases is also encompassed (XQuery etc.).

G06F 17/30926**{Query formulation}****Definition statement***This subgroup covers:*

Examples:

Comparative analysis of XML query languages; graphical XML query language.

G06F 17/30929**{Query processing}****Definition statement***This subgroup covers:*

Example:

Implementing an XML query language.

Query processing in Xyleme - a native XML dbms.

Implementing an XML query language.

G06F 17/30932**{Query translation}****Definition statement***This subgroup covers:*

Translation of a query into internal representation; translation of XML specific query language into SQL as internal representation.

G06F 17/30935**{Query optimisation}****Definition statement***This subgroup covers:*

Example:

XML query (XQuery) optimization and normalization.

G06F 17/30938**{Query execution}****Definition statement***This subgroup covers:*

Execution of one or more (already generated and optimized) query execution plan(s).

Examples:

Pipelined query execution of a ranking operator for XQuery .

Intra-document indices to improve XQuery processing over XML streams.

G06F 17/30943**{details of database functions independent of the retrieved data type}****Definition statement***This subgroup covers:*

Retrieval of information, wherein the retrieval method is not related to any particular type of data. This applies in particular if no specific data type is indicated or implied by the context of the document at all, or an explicit hint is given that the disclosed mechanism can be used for retrieval of arbitrary data types.

G06F 17/30949**{hash tables (hashing functions for network address lookup or routing in networks [H04L 12/5689](#))}****Definition statement***This subgroup covers:*

The situation where data is retrieved by calculating a storage address, for example in a table, file or main memory from a given key, or converting

somehow this key to that storage address; for example using a hashing function to map an information key to the address where that information is stored.

Relationship between large subject matter areas

Accessing data in main memory systems with address translation involving hashing techniques: [G06F 12/1018](#).

References relevant to classification in this group

This subgroup does not cover:

Routing in networks, hashing functions for network address lookup	H04L 12/5689
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G06F 17/30958

{Graphs; Linked lists ([G06F 17/30961](#) takes precedence)}

Definition statement

This subgroup covers:

Systems, methods for managing data structures such as data graphs, linked lists, being specifically adapted for accessing of index data accessible in a chained manner, e.g. including some form of pointers from one index record to one or more other index records

References relevant to classification in this group

This subgroup does not cover:

Trees	G06F 17/30961
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G06F 17/30961

{Trees}

Definition statement

This subgroup covers:

- Details of implementation in memory of the tree structures, compact representations.
- Techniques to (re-)balance trees after updates (e.g. Insertions or deletions).
- Extensions to basic tree structures to offer alternative navigation paths through the trees.

References relevant to classification in this group

This subgroup does not cover:

Management of index trees for structured data stores	G06F 17/30327
Management of index trees for unstructured text data	G06F 17/30625

G06F 17/3097

{using system suggestions}

Definition statement

This subgroup covers:

Facets:

- While inputting a query, the system predicts the most probable next query words and displays a list for the user to choose from using the mouse.

G06F 17/30982

{by using parallel associative memories or content-addressable memories}

Definition statement

This subgroup covers:

- Use of Content Addressable (CAM) or Parallel Associative Memories (PAM) to match search arguments with a large number of elements in parallel.
- Architecture making use of CAM units for speeding up retrieval.

References relevant to classification in this group

This subgroup does not cover:

Internal architecture of CAM, PAM	G11C 15/00
Use of CAM for routing and flow control of packets in data switching networks	H04L 12/5689 , H04L 12/569

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

CAM	Content Addressable Memory
PAM	Parallel Associative Memory

G06F 17/30985

{by using string matching techniques (sequence comparison in bioinformatics [G06F 19/22](#); string matching used for packet routing in packet switching systems [H04L 12/5689](#))}

Definition statement

This subgroup covers:

String matching; e.g. using finite state machines or genetic algorithms.

References relevant to classification in this group

This subgroup does not cover:

Orthographic correction	G06F 17/273
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Informative references

Attention is drawn to the following places, which may be of interest for search:

sequence comparison in bioinformatics	G06F 19/22
string matching used for packet routing in packet switching systems	H04L 12/5689

G06F 17/30988

{by searching ordered data, e.g. alpha-numerically ordered data (sequence comparison in bioinformatics [G06F 19/22](#))}

Definition statement

This subgroup covers:

Searching dictionaries or (alpha-numerically) ordered lists; includes taking advantage on the ordering for binary or simple sequential access.

Informative references

Attention is drawn to the following places, which may be of interest for search:

sequence comparison in bioinformatics	G06F 19/22
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G06F 17/30994

{Browsing or visualization}

Definition statement

This subgroup covers:

Facets:

- Navigating/Browsing a set of generic items (consumer products, homes, wallpaper patterns) using operations like "More of this" and "less of that".
- 3D-based approach of browsing through data items corresponding to files or folders.

G06F 17/30997

{Retrieval based on associated metadata}

Special rules of classification within this group

Documents describing retrieval of arbitrary data types based on a specific type of metadata may in addition be classified in the group corresponding to the data type used for the retrieval, depending on the level of disclosed details concerning the data type used for retrieval.

G06F 17/40

Data acquisition and logging (for input to computer [G06F 3/00](#); {displays as computer output [G06F 3/14](#); for image data processing [G06T 9/00](#); compression in general [H03M 7/30](#); for transmission [H04B 1/66](#); for pictorial communication [H04N](#); arrangements in telecontrol or telemetry systems for selectively calling a substation from a main station [H04Q 9/00](#)})

References relevant to classification in this group

This subgroup does not cover:

Displays as computer output	G06F 3/14
For image data processing	G06T 9/00
Compression in general	H03M 7/30
For transmission	H04B 1/66
For pictorial communication	H04N
Arrangements in telecontrol or telemetry systems for selectively calling a substation from a main station	H04Q 9/00

Special rules of classification within this group

This group is no longer used for the classification of new documents. Documents about data acquisition and logging should be classified in the application field according to the limiting references above.

G06F 17/50

Computer-aided design

Definition statement

This subgroup covers:

- Arrangements and methods, specially adapted for automated execution, for design and simulation of technical entities.
- The application field of the entity designed or simulated takes precedence.
- Methods, lacking adaptations for automated execution, can also be classified here unless provided otherwise.

References relevant to classification in this group

This subgroup does not cover:

Design of implants and prosthetic devices	A61C 13/0004 , A61F 2/30942
Factory automation (CAM)	G05B 19/00
Testing, monitoring and debugging	G06F 11/00
Complex mathematical operations not limited to technical design purpose	G06F 17/10
Virtual reality, interaction with human body	G06F 3/011
Software engineering	G06F 8/00
Software tools	G06F 9/44 , G06F9/45
Three dimensional graphical modelling and manipulation	G06T 17/00 , G06T 19/00
Electronic editing of audio or video signals	G11B 27/031
Computer-aided design of test circuits for static stores	G11C 29/54

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Design	description of technical parameters or a virtual model of a technical arrangement; does not cover aesthetic aspects; not to be confused with the physical object
Verification	determining the correct functioning of a design; not to be confused with testing of a physical object

G06F 17/5009

{using simulation}

Definition statement

This subgroup covers:

Determining technical properties and behaviour by virtual simulation in a computer.

References relevant to classification in this group

This subgroup does not cover:

Simulation of seismic phenomena and design of earth reservoirs	G01V 1/00
Adaptive control using simulation	G05B 13/00
Simulation for teaching or training purposes	G09B 9/10

G06F 17/5018

{using finite difference methods or finite element methods (picture mesh generation [G06T 17/20](#))}

References relevant to classification in this group

This subgroup does not cover:

Picture mesh generation	G06T 17/20
Designing prostheses using FEM	A61F 2002/30955

Informative references

Attention is drawn to the following places, which may be of interest for search:

Injection moulding using FEM	B29C 45/7693
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G06F 17/5022

{Logic simulation, e.g. for logic circuit operation (fault-simulation [G06F 11/261](#); test pattern synthesising [G06F 11/263](#))}

Definition statement

This subgroup covers:

Co-simulation, HW-SW simulation and other computer-implemented simulations for verifying circuit design.

References relevant to classification in this group

This subgroup does not cover:

Test pattern generation	G01R 31/28
Circuit testing	G01R 31/317
Testing simulation	G01R 31/318357
Fault simulation	G06F 11/261

G06F 17/5027

{Logic emulation using reprogrammable logic devices, e.g. field programmable gate arrays [FPGA]}

Definition statement

This subgroup covers:

Using a programmable device (FPGA) for accelerating the simulation.

References relevant to classification in this group

This subgroup does not cover:

Reprogrammable logic devices as such	H03K 19/177
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G06F 17/5031**{Timing analysis}****Definition statement***This subgroup covers:*

Simulation of digital circuits focusing on the timing.

G06F 17/5036**{for analog modelling, e.g. for circuits, spice programme, direct methods, relaxation methods}****Definition statement***This subgroup covers:*

Simulation of circuits (digital and analog) for determining analog (continuous) electrical properties.

G06F 17/504**{Formal methods}****Definition statement***This subgroup covers:*

Using formal method for design verification as well as for specification verification.

G06F 17/5045**{Circuit design ([G06F 17/5068](#) takes precedence; logic circuits [H03K 19/00](#))}****Definition statement***This subgroup covers:*

- Design of electrical circuits at behavioural or functional level of abstraction.
- High-level synthesis.
- Design of a system-on-chip (SoC).
- Co-synthesis or WH-SW synthesis and partitioning.
- HDL, behavioural silicon compilers.

References relevant to classification in this group

This subgroup does not cover:

Physical circuit design	G06F 17/5068
Logic circuits	H03K 19/00

G06F 17/505

{Logic synthesis, e.g. technology mapping, optimisation}

Definition statement

This subgroup covers:

- Low-level synthesis.
- Netlist optimization.

G06F 17/5054

{for user-programmable logic devices, e.g. field programmable gate arrays [FPGA]}

References relevant to classification in this group

This subgroup does not cover:

Programmable devices as such	H03K 19/177
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G06F 17/5081

{Layout analysis, e.g. layout verification, design rule check}

References relevant to classification in this group

This subgroup does not cover:

Assist features and mask correction	G03F 1/144
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G06F 17/5086

{Mechanical design, e.g. parametric or variational design}

Definition statement

This subgroup covers:

Design of mechanical systems in regard to moving parts, dimension tolerances etc.

G06F 17/509

{Network design, e.g. positioning, routing, graphs (circuit design [G06F 17/5068](#))}

Definition statement

This subgroup covers:

Using network design techniques or graph theories for determining the position of elements in a design.

References relevant to classification in this group

This subgroup does not cover:

Circuit design	G06F 17/5068
Computer networks design	H04L 12/2456

G06F 19/00

Digital computing or data processing equipment or methods, specially adapted for specific applications ([G06F 17/00](#) takes precedence; data processing systems or methods specially adapted for administrative, commercial, financial, managerial, supervisory or forecasting purposes [G06Q](#))

Definition statement

This group covers:

Digital computing or data processing equipment or methods specially adapted for the fields of healthcare or life sciences: Bioinformatics, Chemoinformatics and Medical Informatics

No document should be classified in this main group, but only in its subgroups. This main group has merely a tree structure function.

Relationship between large subject matter areas

Digital computing or data processing equipments or methods specially adapted to other areas than healthcare or life sciences are not covered by this group.

References relevant to classification in this group

This group does not cover:

Digital computing or data processing equipment or methods, specially adapted for specific functions	G06F 17/00
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Data processing systems or methods specially adapted for administrative, commercial, financial, managerial, supervisory or forecasting purposes	G06Q
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Medical or veterinary science	A61
Physical training (fitness)	A63B
Peptides	C07K
Measuring or testing involving enzymes or micro-organisms	C12Q
Combinatorial chemistry	C40B
Investigating or analysing materials by determining their chemical or physical properties	G01N
Pattern recognition	G06K 9/00
Computer systems based on specific computational models	G06N
Business methods	G06Q
Image data processing	G06T

G06F 19/10

Bioinformatics, i.e. methods or systems for genetic or protein-related data processing in computational molecular biology (in silico methods of screening virtual chemical libraries [C40B 30/02](#); in silico or mathematical methods of creating virtual chemical libraries [C40B 50/02](#))

Definition statement

This subgroup covers:

Methods or systems for genetic or protein related data processing in computational molecular biology.

This group also covers bioinformatics methods or systems where the digital data processing is inherent or implicit, although not explicitly mentioned.

References relevant to classification in this group

This subgroup does not cover:

In silico methods of screening virtual chemical libraries	C40B 30/02
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In silico or mathematical methods of creating virtual chemical libraries	C40B 50/02
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Medical diagnosis	A61B 5/00
Manufacture of microarrays, DNA chips	B01J 19/00 , C12M 1/34
PCR apparatus per se	B01L 7/00 , C12M 1/38
Macromolecular X-ray crystallographic or NMR structures per se	C07K 14/00
Genetic engineering involving nucleic acids	C12N 15/00
Chemical reactions involving the use of microarrays, DNA chips	C12Q 1/68
Sequencing using PCR	C12Q 1/68
Gel electrophoresis apparatus per se	G01N 27/447
Sequencing using electrophoresis	G01N 27/447
Sequencing using chromatography	G01N 30/00
Sequencing using mass spectrometry	G01N 33/68
Information retrieval, databases per se	G06F 17/30
Computer input/output arrangements	G06F 3/00
Computer architectures or program control	G06F 9/00
Pattern recognition	G06K 9/00
Computer systems using neural network models per se	G06N 3/02
Computer systems using knowledge representation per se, e.g. expert systems	G06N 5/02
Computer systems using probabilistic models per se	G06N 7/00
Finding positions and orientations in microarray images by image processing	G06T 7/00
Mass spectrometry apparatus per se	H01J 49/00

Special rules of classification within this group

In this group, the first place priority rule is applied, i.e. at each hierarchical level, classification is made in the first appropriate place. The places under

the section Informative references should be considered for circulation at the classification stage.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Molecular structure	2-dimensional or 3-dimensional arrangement of atoms, groups of atoms or domains in nucleic acids, proteins, peptides and amino acids
Genome annotation	allocation of functions to individual genes in the genome
Genotyping	analysis of an organism's genotype
Ontology	classification methodology for formalising a subject's knowledge in a structured and controlled vocabulary
Taxonomy	classification of organisms to show their evolutionary relationships to other organisms
Programming tools or database systems	computer software to assist programming procedures within bioinformatics and database systems for managing genetic/ protein-related data
Syntenic regions	corresponding regions in a species to an observed grouping of genes in the same order and on the same chromosome in another species
Probe design and optimisation for microarrays	designing and selecting (i) optimal, highly specific probes, e.g. oligonucleotides, cDNA, fragments for hybridisation experiments with microarrays and (ii) optimal sets of probes, e.g. oligonucleotides, cDNA, to be chemically attached to a solid support to form an array
Gene expression profiling	determination of the pattern of genes expressed, i.e. transcribed, under specific circumstances or in a specific cell line
Data mining	discovery and analysis of patterns within a vast amount of genetic or protein-related data
Sequencing by hybridisation	DNA sequencing technique in which an array of short sequences of nucleotides is brought in contact with a solution of a target DNA sequence, a biochemical method determines a subset of probes that bind to the target sequence and a combinatorial method is then used to reconstruct the DNA sequence from the spectrum

Domain	domain of a protein is an element of the overall molecular structure that is self-stabilising and often folds independently of the rest of a polypeptide chain
Drug targeting	drug design strategy aiming at optimising the properties of a medicinal compound, based on the 3-dimensional structure of a target, for delivery to a particular tissue or organ in the body
Functional genomics	experimental analyses aiming at assessing the function of genes in determining traits, physiology and/or development of an organism, making use of computational and high-throughput technologies
Pedigree	family tree describing the occurrence of heritable traits across generations
Structure alignment	form of alignment to establish structural and functional equivalences between two or more proteins based on their secondary or tertiary structures
Data visualisation	generation and/or display of graphical representations of genetic and protein-related data
Genotype	genetic makeup or profile of an organism with respect to a trait
Orthologue	homologous sequence found in different species and derived from a common ancestor
Parologue	homologous sequence in the same organism derived from gene duplication
Homology	indication of the amount of similarity between two sequences; homology determinations can include allowance for gaps, insertions, deletions and mismatches between the aligned sequences
Proteomics	large-scale study of the functions of proteins and their interactions with other molecular entities in a biological system
Fragment assembly	method by which linear portions of sequence information are assembled to obtain full length gene sequence data
Gene finding	method of searching genomic DNA sequences to identify open reading frames which encode proteins
Noise correction model	model that accounts for non-signal data, such as for microarrays: optical noise, quality control problems and cross hybridisation

Microarray	plurality of nucleic acid probes attached to a substrate, which form an ordered pattern
Protein folding	process by which a polypeptide chain folds into a specific 3-dimensional structure
Gene expression	process by which proteins are made or transcribed from the instructions encoded in DNA
Sequence comparison	process of comparing nucleic or amino acid sequences, generally by a linear alignment in such a way that equivalent positions in adjacent sequences are brought into the correct alignment with each other by introducing insertions in suitable positions, in order to identify similarities and/or differences amongst the compared sequences
Phylogeny	reconstruction of an evolutionary development and history of a species or higher taxonomic grouping of organisms; typically represented as a phylogenetic tree; methods for creating phylogenetic trees
Haplotype	set of one or more polymorphisms (sequence variations) that may be found at a particular genetic location on the same chromosome
Systems biology	simulation and mathematical modelling of relationships and interactions between molecular entities in sub-cellular systems integrating genetic and/or protein-related data to describe the dynamic behaviour of, for example, protein-protein/protein-ligand interactions, regulatory networks and metabolic networks
SNP	single nucleotide polymorphism: a DNA sequence variation that involves a change in a single nucleotide and is commonly present in a part of a population
Motif	specific nucleotide or amino acid sequence pattern
Population genetics	study of genetic variation and genetic evolution of populations
Linkage disequilibrium	tendency of alleles located close to each other on the same chromosome to be inherited together
Phylogenetic tree	tree-like graphical representation of phylogenetic relationships

Synonyms and Keywords

In this group, the following term is used with the meaning indicated:

- "systems" includes apparatus.

G06F 19/12

for modelling or simulation in systems biology, e.g. probabilistic or dynamic models, gene-regulatory networks, protein interaction networks or metabolic networks

Definition statement

This subgroup covers:

Simulation or mathematical modelling of relationships and interactions between molecular entities on a subcellular level, integrating genetic and/or protein-related data to describe the dynamic behaviour of protein-protein/protein-ligand interactions, regulatory or metabolic networks.

Mere mention of modelling or simulation is not sufficient to justify classification in this group. In such cases, see the other subgroups of group [G06F 19/10](#) following this one in the scheme.

G06F 19/14

for phylogeny or evolution, e.g. evolutionarily conserved regions determination or phylogenetic tree construction

Definition statement

This subgroup covers:

Analysis of orthologous, paralogous, syntenic or taxonomic relationships.

Generation of pedigrees and phylogenetic trees.

Mere mention of evolutionary data is not sufficient to justify classification in this group. In such cases, see the other subgroups of group [G06F 19/10](#) following this one in the scheme.

G06F 19/16

for molecular structure, e.g. structure alignment, structural or functional relations, protein folding, domain topologies, drug targeting using structure data, involving two-dimensional or three-dimensional structures

Definition statement

This subgroup covers:

Structural architecture of proteins, peptides, amino acids and nucleic acids and the prediction thereof.

Processes including structural alignment, protein folding, domain topology, molecular modelling, receptor-ligand modelling, docking methods, structural-functional relationships and drug targeting using structure data, as well as two- and three-dimensional structure prediction and/or analysis.

The structure types include secondary, tertiary and quaternary structures.

Mere mention of structural data is not sufficient to justify classification in this group. In such cases, see the other subgroups of group [G06F 19/10](#) following this one in the scheme.

G06F 19/18

for functional genomics or proteomics, e.g. genotype-phenotype associations, linkage disequilibrium, population genetics, binding site identification, mutagenesis, genotyping or genome annotation, protein-protein interactions or protein-nucleic acid interactions

Definition statement

This subgroup covers:

Assessment of the function of genes and proteins in determining traits, physiology and/or development of an organism, making use of computational and large scale, high-throughput technologies.

Genotypic-phenotypic associations, including genotyping and genome annotation, linkage disequilibrium analysis and association studies, population genetics, alternative splicing and Short Interfering RNA design (siRNA, RNAi).

Binding site identification, mutagenesis analysis, protein-protein or protein-nucleic acid interactions.

Mere mention of gene or protein function is not sufficient to justify classification in this group. In such cases, see the other subgroups of group [G06F 19/10](#) following this one in the scheme.

G06F 19/20

for hybridisation or gene expression, e.g. microarrays, sequencing by hybridisation, normalisation, profiling, noise correction models, expression ratio estimation, probe design or probe optimisation

Definition statement

This subgroup covers:

Analysis of gene expression information. This includes microarray analysis, gel electrophoresis analysis and sequencing by hybridisation. Further covered technologies include probe design and probe optimisation, microarray normalisation, expression profiling, noise correction models, expression ratio estimation.

Mere mention of hybridisation or gene expression is not sufficient to justify classification in this group. In such cases, see the other subgroups of group [G06F 19/10](#) following this one in the scheme.

Relationship between large subject matter areas

This group does not cover base calling in sequencing methods. Such subject matter is classified under the relevant places for the corresponding sequencing method as listed under the section Informative references for group [G06F 19/10](#).

G06F 19/22

for sequence comparison involving nucleotides or amino acids, e.g. homology search, motif or SNP [Single-Nucleotide Polymorphism] discovery or sequence alignment

Definition statement

This subgroup covers:

Comparison of sequence information, wherein the sequences are nucleic acids or amino acids. The comparisons include methods of alignment, homology identification, motif identification, SNP (Single-Nucleotide Polymorphism) discovery, haplotype identification, fragment assembly, gene finding.

Mere mention of sequence data is not sufficient to justify classification in this group. In such cases, see the other subgroups of group [G06F 19/10](#) following this one in the scheme.

G06F 19/24

for machine learning, data mining or biostatistics, e.g. pattern finding, knowledge discovery, rule extraction, correlation, clustering or classification

Definition statement

This subgroup covers:

Discovery and/or analysis of patterns within a vast amount of genetic or protein-related data, wherein the emphasis is placed on the method of analysis and is largely independent of the type of bioinformatic data. Covered methods include bioinformatic pattern finding, knowledge discovery, rule extraction, correlation, clustering and classification.

Multivariate analysis of protein or gene-related data, e.g. analysis of variances (ANOVA), principal component analysis (PCA), support vector machines (SVM).

G06F 19/26

for data visualisation, e.g. graphics generation, display of maps or networks or other visual representations

Definition statement

This subgroup covers:

Visual representations specifically adapted to bioinformatic data, wherein the emphasis is placed on the method of visualisation and is largely independent of the type of bioinformatic data. Visualisation of bioinformatic data specifically includes, for example, graphics generation, map display and network display.

G06F 19/28

for programming tools or database systems, e.g. ontologies, heterogeneous data integration, data warehousing or computing architectures

Definition statement

This subgroup covers:

Computer software specifically adapted to assist programming procedures within bioinformatics and database systems specifically adapted for managing bioinformatic data. This includes ontologies, heterogeneous data integration, data warehousing, computing architectures.

G06F 19/30

{Medical informatics, i.e. computer-based analysis or dissemination of patient or disease data (bioinformatics [G06F 19/10](#); measuring for diagnostic purposes [A61B 5/00](#); recognising patterns in biomedical signals [G06K 9/00496](#); data processing systems or methods specially adapted for administrative or managerial aspects of healthcare or welfare [G06Q 50/22](#))}

Definition statement

This subgroup covers:

Medical Informatics, also called Healthcare Informatics, Health Informatics, Clinical Informatics or Biomedical Informatics.

Medical Informatics is a discipline at the intersection of information science, computer science and health care.

It deals with the resources, devices, and methods required to optimise the acquisition, storage, retrieval, and use of information in healthcare and biomedicine. Medical Informatics tools include not only computers but also clinical guidelines, formal medical terminologies, and information and communication systems.

It is applied to the areas of nursing, clinical care, dentistry, pharmacy, public health, occupational therapy, and (bio)medical research.

No document should be classified in this group, but only in its lower subgroups. This group has merely a tree structure function.

Relationship between large subject matter areas

In order to differentiate Medical Informatics from Bioinformatics or Chemoinformatics, we highlight that the focus of Medical Informatics is on patients or diseases (e.g. diagnosis or treatments), whereas the focus of Bioinformatics and Chemoinformatics is on proteins, molecules or DNA.

Documents dealing with analogue electrical medical signals (ECG, EKG, etc) are classified under [A61](#) for acquisition (measuring), and under [G06K 9/00](#) for analysis (pattern recognition).

References relevant to classification in this group

This subgroup does not cover:

Bioinformatics	G06F 19/10
Chemoinformatics	G06F 19/70

Informative references

Attention is drawn to the following places, which may be of interest for search:

Medical or veterinary science	A61
Detecting, measuring or recording for diagnostic purposes	A61B 5/00
Surgical instruments, devices or methods	A61B 17/00
Physical training (fitness)	A63B
Investigating biological material	G01N 33/48
Recognising patterns in biomedical signals	G06K 9/00496
Business methods	G06Q
Biomedical image inspection	G06T 7/0012
Biomedical image modelling	G06T 17/00

Special rules of classification within this group

Multiple places no priority - for all the lower subgroups of this group, unless exceptionally specified different in the particular subgroup(s).

G06F 19/32

{Medical data management, e.g. systems or protocols for archival or communication of medical images, computerised patient records or computerised general medical references (information retrieval or databases per se [G06F 17/30](#); data security aspects [G06F 21/00](#))}

Definition statement

This subgroup covers:

Normally no document should be classified in this group, but only in its lower subgroups. This group has merely a tree structure function.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Information retrieval and databases per se	G06F 17/30
Security aspects per se	G06F 21/00

G06F 19/321

{Management of medical image data, e.g. communication or archiving systems such as picture archiving and communication systems [PACS] or related medical protocols such as digital imaging and communications in medicine protocol [DICOM]; Editing of medical image data, e.g. adding diagnosis information (image data processing in general [G06T](#), image data processing related to 3D objects [G06F 17/00](#); biomedical image inspection [G06T 7/0012](#))}

Definition statement

This subgroup covers:

Systems dealing with medical image transmission and archiving, and related protocols. Usually called Picture Archiving and Communication Systems (PACS), Digital Imaging and Communications in Medicine protocol (DICOM).

This subgroup also covers editing of medical image data, for example adding the doctor's diagnosis to the image.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Image analysis	G06T 7/0012
Editing figures and text; Combining figures or text per se	G06T 11/60
Edit video signals	G11B 27/00
Image enhancement	H04N 5/325
Transmission of medical images	H04N 7/00

Synonyms and Keywords

In patent documents the following abbreviations are often used:

PACS	Picture Archiving and Communication System
DICOM	Digital Imaging and Communications in Medicine
HL7	Health Level Seven

In patent documents the words "image" and "picture" are often used as synonyms.

G06F 19/322

{Management of patient personal data, e.g. patient records, conversion of records or privacy aspects}

Definition statement

This subgroup covers:

Databases used to manage and store patient dependent data for one specific patient.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Information retrieval and databases per se	G06F 17/30
Security aspects per se	G06F 21/00

G06F 19/323

{on a portable record carrier, e.g. CD, smartcard or RFID}

Definition statement

This subgroup covers:

Documents where at least part of the data linked to a patient are stored on a device carried by the patient. Often used for patient identification or fast access to patient medical information by emergency services.

Documents dealing with RFID tags for patients are classified here.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Data security	G06F 21/00
Constructional details cards	G06K 19/00
Recording on cards	G11B 7/00

G06F 19/324

{Management of patient independent data, e.g. medical references in digital format}

Definition statement

This subgroup covers:

Management of medical data not linked to a specific individual, for professional or educational usage.

Special rules of classification within this group

Documents will be classified in this group only if not possible to classify them in its lower subgroups.

G06F 19/325

{Medical practices, e.g. general treatment protocols}

Definition statement

This subgroup covers:

Systems dealing with general medical protocols, not for a particular patient.

G06F 19/326

{Medication information, e.g. drug reference databases}

Definition statement

This subgroup covers:

Systems dealing with general drug information (usage, side effects).

G06F 19/327

{Management of hospital data, e.g. scheduling of medical staff or operation rooms, measuring the quality or efficiency of medical staff}

Definition statement

This subgroup covers:

Support systems for the management of health care facilities.

Documents dealing with RFID tags for medical devices are classified here.

Documents dealing with computer networks for hospitals which can not be classified under telemedicine are classified here.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Business methods	G06Q
Computer networks	H04L 29/00

G06F 19/328

{Health insurance management, e.g. payments or protection against fraud}

Definition statement

This subgroup covers:

Documents dealing with insurances and payments.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Payment schemes	G06Q 20/00
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G06F 19/34

{Computer-assisted medical diagnosis or treatment, e.g. computerised prescription or delivery of medication or diets, computerised local control of medical devices, medical expert systems or telemedicine}

Definition statement

This subgroup covers:

Computerised diagnosis or treatment.

Normally no document should be classified in this group, but only in its lower subgroups. This group has merely a tree structure function.

G06F 19/3406

{Local monitoring or local control of medical devices, e.g. configuration parameters, graphical user interfaces [GUI] or dedicated hardware interfaces}

Definition statement

This subgroup covers:

Automated or user interface control of local medical devices, as well as documents comprising hardware interfaces for computerised medical devices.

Informative references

Attention is drawn to the following places, which may be of interest for search:

All types of patient monitors	A61B 5/00
Manual calculators	G06C 3/00
User interfaces	G06F 3/00
Pocket computers	G06F 15/02
Mechanical computers	G06G 1/001
Remote controls	G08C 17/02
Altering GUIs for vision deficiency	H04N 1/6058

Special rules of classification within this group

Graphical user interfaces used in Medical Informatics for purposes other than local control or monitoring are classified in the corresponding use-specific subgroups.

Computer-assisted distribution of medication from dispensers, i.e. making sure that medication is correctly delivered to patients, is classified in the subgroup [G06F 19/3462](#).

Computer-assisted delivery of medication via infusion or injection is classified in the subgroup [G06F 19/3468](#).

G06F 19/3412

{Medical equipment management, e.g. updates or maintenance}

Definition statement

This subgroup covers:

Maintenance, update, upgrade, servicing, calibrating and mending of computerised medical equipment.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Reliability control for systems (e.g. sensors)	G05B 23/00
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G06F 19/3418

{Telemedicine, e.g. remote diagnosis, remote control of instruments or remote monitoring of patient carried devices}

Definition statement

This subgroup covers:

Remote medical diagnosis and medical care - monitoring, testing, controlling and communicating.

Observation: The medical professional can also be an expert system running on a server.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Computer networks, wireless applications	H04L 29/00
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Special rules of classification within this group

A doctor controlling an operation arm using a wireless joystick located in the same room will not be classified here but in the Local monitoring or local control of medical devices subgroup ([G06F 19/3406](#)).

Documents comprising remote testing where data is sent to a server and the result is sent back to the patient belong here. However, if a specimen itself is sent, the application should be classified in the Acquisition of data related to laboratory tests subgroup ([G06F 19/366](#)).

G06F 19/3425

{Consulting other medical practitioners, e.g. cooperation, by teleconferencing}

Definition statement

This subgroup covers:

Systems which allow different medical professionals to communicate to each other via computer networks.

The standard type is a general practitioner asking for advice from a specialist over the network.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Business methods	G06Q
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G06F 19/3431

{Calculating a health index for the patient, e.g. for risk assessment}

Definition statement

This subgroup covers:

Calculating a health index for the patient, e.g. for risk assessment, biorhythms, diet, treatment, etc.

G06F 19/3437

{Medical simulation or modelling, e.g. simulating the evolution of medical disorders (computer-aided design using simulation [G06F 17/5009](#); biomedical image modelling [G06T 17/00](#))}

Definition statement

This subgroup covers:

Simulation and modelling of biological systems and medical procedures, simulation of disease patterns, simulation of body parts and simulation of surgical procedures.

In these documents, the goal of the method is to find the best treatment solution for a certain problem.

Relationship between large subject matter areas

Most of the image related simulation files are treated in the 3D image generation group ([G06T 17/00](#)) and in the prosthesis group ([A61F 2/00](#)).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Dental prostheses	A61C 13/0004
Prostheses	A61F 2/00
Modelling machines (e.g. which produce prostheses)	G05B 19/4207
Cells simulation	G06F 19/10
Computer aided design using simulation	G06F 17/5009
3D Image generation	G06T 17/00
Simulation for learning purposes	G09B 23/00

G06F 19/3443

{Medical data mining, e.g. in previous cases of different patients (pattern recognition in general [G06K 9/62](#))}

Definition statement

This subgroup covers:

Systems using data mining methods on previous cases of different patients in order to find correlations with a current patient for diagnosis and treatment purpose.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Pattern recognition per se	G06K 9/62
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Special rules of classification within this group

Retrospective studies (post analysis) are classified here, while prospective studies (clinical trials) are classified in the Manual data input subgroup ([G06F 19/363](#)).

Documents mining through records of only one single person may not be classified in this subgroup, but in the Management of patient personal data subgroup ([G06F 19/322](#)).

G06F 19/345

{Medical expert systems, neural networks or other automated diagnosis (computer systems utilising knowledge based models [G06N 5/00](#); neural networks per se [G06N 3/02](#))}

Definition statement

This subgroup covers:

Medical decision support systems.

Intelligent computer aided diagnosis (CAD) systems.

Automated diagnosis is classified here even if the algorithms are not very complex.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Neural networks per se	G06N 3/00
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Expert systems per se	G06N 5/00
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G06F 19/3456

{Computer-assisted prescription or delivery of medication, e.g. prescription filling or compliance checking}

Definition statement

This subgroup covers:

Prescription, dispensing, management, controlling and administration of medication.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Medicinal preparations	A61K 9/00
Chemoinformatics	G06F 19/70

Special rules of classification within this group

General drug reference databases are classified in the Medication information subgroup ([G06F 19/326](#)).

Computer-assisted distribution of medication from dispensers, i.e. making sure that medication is correctly delivered to patients, is classified in the subgroup [G06F 19/3462](#).

Computer-assisted delivery of medication via infusion or injection is classified in the subgroup [G06F 19/3468](#).

G06F 19/3462

{Computer-assisted distribution of medication from dispensers, i.e. making sure that medication is correctly delivered to patients (medication containers [A61J 1/00](#); dispensers activated by money or the like [G07F](#))}

Definition statement

This subgroup covers:

Computer-managed delivery of medication from dispensers, i.e. making sure that the correct medication is delivered to the correct patient.

Documents dealing with RFID tags for drugs are classified here.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Medication (drug) containers	A61J 1/00
Dispensers activated by money or the like	G07F

G06F 19/3468

{Computer-assisted delivery of medication via infusion or injection (infusion devices per se [A61M 5/14](#))}

Definition statement

This subgroup covers:

Computer-managed delivery of medication via infusion or injection.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Infusion devices per se	A61M 5/14
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G06F 19/3475

{Computer-assisted prescription or delivery of diets, e.g. prescription filling or compliance checking}

Definition statement

This subgroup covers:

Prescription or control of nutrition or diet, treatment by diet.

G06F 19/3481

{Computer-assisted prescription or delivery of treatment by physical action, e.g. surgery or physical exercise (surgical instruments, devices or methods [A61B 17/00](#); apparatuses for physical training [A63B](#))}

Definition statement

This subgroup covers:

Systems for defining a treatment for an individual after diagnosis. Treatment should involve a physical action on a patient (is not mere medication or nutrition).

Informative references

Attention is drawn to the following places, which may be of interest for search:

Radiation therapy	A61B 6/00
Surgery	A61B 17/00
Sleep disorders	A61M 16/00
Fitness	A63B
Magnetic resonance per se	G01R 33/00

G06F 19/3487

{Medical report generation}

Definition statement

This subgroup covers:

Generation of a report based on diagnosis. Can be on paper or on the screen.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Drawing of charts or graphs per se	G06T 11/206
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Special rules of classification within this group

If a report is created by an automated system comprising merely the summarization of the answers a patient gave to a doctor during an interview, the document should be classified in the Manual data input subgroup ([G06F 19/363](#)).

G06F 19/3493

{Computer-assisted epidemiological alert systems, e.g. bioterrorism or flu alerts}

Definition statement

This subgroup covers:

Systems which trigger alerts (epidemiologic, bioterrorism) if unusual patterns are detected in (medical) databases corresponding to certain geographical regions.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Pattern recognition per se	G06K 9/62
Alerts	G08B 21/00

Special rules of classification within this group

Do not confuse with the Medical data mining subgroup ([G06F 19/3443](#)), where documents are put if the data mining is for diagnosis or treatment purpose.

G06F 19/36

{Computer-assisted acquisition of medical data, e.g. computerised clinical trials or questionnaires (measuring analogue medical signals [A61B 5/00](#))}

Definition statement

This subgroup covers:

Computerised acquisition of medical data.

Normally no document should be classified in this group, but only in its lower subgroups. This group has merely a tree structure function.

Relationship between large subject matter areas

This subgroup does not deal with measuring analogue electrical medical signals, which is the topic of [A61B 5/00](#).

G06F 19/363

{Manual data input, e.g. electronic questionnaires or clinical trials}

Definition statement

This subgroup covers:

Acquisition of medical data, e.g. questionnaires and clinical trials.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Medical data input in paper forms	A61B 5/00
Form filling per se	G06F 17/243
Questionnaires related to teaching	G09B 5/00

G06F 19/366

{Acquisition of data related to laboratory tests, e.g. special identifiers for examination containers (investigating biological material [G01N 33/48](#))}

Definition statement

This subgroup covers:

Computer systems which supervise the process of sending biological specimens to laboratory for analysis.

RFID tags for laboratory containers are classified here.

Relationship between large subject matter areas

This subgroup does not deal with tissue analysis, blood analysis, disease markers, and protein concentration in samples, which are topics of [G01N 33/48](#), [A61K 39/00](#) and/or [C12Q 1/00](#).

References relevant to classification in this group

This subgroup does not cover:

Laboratory tests per se	G01N 33/48
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Laboratory containers with tags	B01L 3/545
RFID tags per se	G06K 17/00

Special rules of classification within this group

If a specimen is sent to a laboratory the document belongs here; if data is sent to a server and analysed and the result is sent back to the patient the document belongs to the Telemedicine subgroup ([G06F 19/3418](#)).

G06F 19/70

{Chemoinformatics, i.e. data processing methods or systems for the retrieval, analysis, visualisation, or storage of physicochemical or structural data of chemical compounds (in silico methods of screening virtual chemical libraries [C40B 30/02](#); in silico or mathematical methods of creating virtual chemical libraries [C40B 50/02](#); computer-aided design per se [G06F 17/50](#); bioinformatics [G06F 19/10](#); processing of 2D or 3D images [G06T](#))}

Definition statement

This subgroup covers:

Data processing methods or systems for the retrieval, analysis, visualisation or storage of physicochemical or structural data of chemical compounds.

This group also covers chemoinformatics methods or systems where the digital data processing is inherent or implicit, although not explicitly mentioned.

References relevant to classification in this group

This subgroup does not cover:

In silico methods of screening virtual chemical libraries	C40B 30/02
In silico or mathematical methods of creating virtual chemical libraries	C40B 50/02
Computer-aided design per se	G06F 17/50
Bioinformatics, i.e. methods or systems for genetic or protein-related data processing	G06F 19/10
2-D or 3-D image generation per se	G06T 11/00 - G06T 17/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Computer input/output arrangements	G06F 3/00
Computer architectures or program control	G06F 9/00
Information retrieval, databases per se	G06F 17/30
Pattern recognition	G06K 9/00
Investigating or analysing materials by determining their chemical or physical properties	G01N
Computer systems using neural network models per se	G06N 3/02

Computer systems using knowledge representation per se, e.g. expert systems	G06N 5/02
Computer systems using probabilistic models per se	G06N 7/00

Special rules of classification within this group

The places under the section Informative references should be considered for circulation at the classification stage.

Synonyms and Keywords

In this group, the following term is used with the meaning indicated:

"systems" includes apparatus.

G06F 21/00

Security arrangements for protecting computers, components thereof, programs or data against unauthorised activity {(address-based protection against unauthorised use of memory [G06F 12/14](#); record carriers for use with machines and with at least a part designed to carry digital markings [G06K 19/00](#); preventing unauthorised reproduction or copying of disk-type recordable media [G11B 20/00](#); secret or secure communication [H04L 9/00](#); digital watermarking on images [H04N 1/32](#); protection in video systems or pay television [H04N 7/16](#)}}

References relevant to classification in this group

This group does not cover:

Error detection/correction by redundancy; backup	G06F 11/00
Address-based protection against unauthorised use of memory	G06F 12/14
Preventing unauthorised reproduction or copying of disk-type recordable media	G11B 20/00
Network administration	H04L 12/24
Security arrangements for protecting computers or computer systems when network involvement or protocols are of relevance.	H04L 29/06
Arrangements for secret or secure communication wherein the cryptographic algorithms are of a relevance	H04L 9/00
Digital watermarking on images	H04N 1/32
Protection in video systems or pay television	H04N 7/16
When security or authentication arrangements in wireless communication networks are of relevance.	H04W 12/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Data switching networks	H04L 12/00
Key distribution in cryptographic systems	H04L 9/08
Algorithms, certificates, signatures, hash functions, encryption	H04L 9/32
Dispensing apparatus actuated by coded identity card or credit card	G07F 7/08
Multiprogramming	G06F 9/46
Electric safety arrangements in control or regulating systems	G05B 9/02
Electric program-control in control or regulating systems	G05B 19/02
Program control, executing machine-instructions, program loading or initiating in general, task interaction, specific resource access rights	G06F 9/00
Error detection, error correction, monitoring	G06F 11/00
Record carriers for use with machines and with at least a part designed to carry digital markings	G06K 19/00
Protecting identification code in record carriers	G06K 19/073
Data processing adapted for administrative, commercial, managerial, supervisory or forecasting purposes	G06Q
Dispensing apparatus actuated by coded identity card or credit card	G07F 7/08
Complete banking systems	G07F 19/00
Alarms or alarm systems	G08B 13/00- G08B 31/00
Equipment anti-theft monitoring by a central station	G08B 26/00
Ciphering apparatus	G09C
Information storage based on relative movement between record carrier and transducer	G11B
Arrangements for conditional access to broadcast information using cryptography	H04H 60/23
Secret or secure communication, e.g. including authentication means	H04L 9/00- H04L 9/32
Scanning, transmission or reproduction of documents	H04N 1/00
Selective content distribution, e.g. interactive television, video on demand	H04N 21/00

Special rules of classification within this group

The general rule is to limit to the best-suited group but there could be a plurality of groups for a document if that document discloses many relevant aspects when taken separately (e.g. a document having isolated disclosures) or in combination, in particular when a combination of groups is more suited to reflect the disclosure.

G06F 21/10

Protecting distributed programs or content, e.g. vending or licensing of copyrighted material

Definition statement

This subgroup covers:

Protecting software against unauthorised usage in a vending or licensing environment, e.g. protecting the software provider's copyright. The protection is generic, i.e. not specific to the type of content.

Protecting data in an environment substantially outside the data owner's control (or in a hostile environment). The term "hostile environment" means data and operational environment of the data are controlled by different entities.

Example: hostile environment: FT(Financial Times) has a server where users who pay get a key that enables locally stored encrypted FT-newspaper-articles to be decrypted and read. The articles are in a hostile environment, the computer of the user, where FT has limited or no influence, therefore the article needs to be protected from the user, in this case by encryption

References relevant to classification in this group

This subgroup does not cover:

If protection is restricted to techniques specific to executables	G06F 21/12
Protecting data in an environment substantially within the data owner's control (or in a non-hostile environment)	G06F 21/60
Usage of faulty sectors for copy protection	G11B 20/00086
Protection in video systems, games, pay television when the protection is dependent on the format of the audio/video data e.g. adding security frames in a MPEG signal	H04N 21/00
Digital watermarking on images when the watermarking itself is concerned	H04N 1/32144

Image watermarking when the watermarking itself is concerned	G06T 1/0021
Preventing unauthorized non-electronic copying	G03G 21/04
Preventing unauthorized electronic reproduction of physical documents	H04N 1/00838

Informative references

Attention is drawn to the following places, which may be of interest for search:

Protecting content in television systems	H04N 21/00
Preventing of unauthorized reproduction or copying of media	G11B 20/00086
Games systems, i.e. specific solutions for security of games	G06F 2221/2109
Commerce, e.g. marketing, shopping, billing, auctions or e-commerce	G06Q 30/00
Chip on media	G06F 2221/2121

Special rules of classification within this group

[G06F 2221/07](#) and subgroups are used in combination with this group.

G06F 21/105

{Tools for software license management or administration, e.g. managing licenses at corporate level}

Definition statement

This subgroup covers:

Examples: Managing floating licenses.

G06F 21/12

Protecting executable software

Definition statement

This subgroup covers:

Protection is restricted to techniques specific to executables.

References relevant to classification in this group

This subgroup does not cover:

If the protection is suitable for generic content, although claiming being adapted for protection of an executable	G06F 21/10
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G06F 21/123

{by using dedicated hardware, e.g. dongles, smart cards, cryptographic processors, global positioning systems [GPS] devices}

Definition statement

This subgroup covers:

Dedicated hardware is used for authorizing access to an executable program using techniques specific to executable programs (e.g. manipulation of the code, manipulation of the instruction flow or data flow, security routine in the program to verify a code in a dongle).

References relevant to classification in this group

This subgroup does not cover:

If a security procedure contained in a dongle is used to check a code in the content, no need for code attached to content	G06F 21/10 , G06F 2221/0797
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Authenticating in combination with an additional device	G06F 21/34
If the program contains security routines acting after initial authorization	G06F 21/54
Location-sensitive	G06F 2221/2111

G06F 21/14

against software analysis or reverse engineering, e.g. by obfuscation

Definition statement

This subgroup covers:

Be aware that the software generally stays unlocked. Obfuscation is primarily used to prevent reverse engineering but not to prevent copying.

Examples: Program code is altered at each execution, program flow is changed to mask calls to sensitive routines, data flow is changed, compiling techniques normally performed by code optimizers rolled back.

Informative references

Attention is drawn to the following places, which may be of interest for search:

If similar techniques as the ones used for obfuscation are used to restrict unauthorized usage and thus copy protection	G06F 21/125
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G06F 21/30

Authentication, i.e. establishing the identity or authorisation of security principals

References relevant to classification in this group

This subgroup does not cover:

If the network plays a role, e.g. secure socket layer, IPsec, Internet Key Exchange, or Extensive Authentication Protocol	H04L 29/06755
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Informative references

Attention is drawn to the following places, which may be of interest for search:

One-time-passwords	H04L 29/06789
Time-dependent-passwords, e.g. periodically changing passwords	H04L 29/06795
Authentication using challenge-response	G06F 2221/2103
Bluffing e.g. pretending to have connected a user to a real node when in fact the connection is to a dummy node	G06F 2221/2127
Lost password, i.e. recovery of lost or forgotten passwords	G06F 2221/2131
Verifying human interaction, e.g. Captcha	G06F 2221/2133
Metering, i.e. counting events for security purposes	G06F 2221/2135
Time limited access e.g. to a computer	G06F 2221/2137
Recurrent verification	G06F 2221/2139
Clearing memory or data when detecting an attack e.g. to prevent the data from being stolen	G06F 2221/2143

Time stamp	G06F 2221/2151
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G06F 21/305

{by remotely controlling device operation}

Definition statement

This subgroup covers:

Authentication is not triggered by a user but imposed/initiated by a third party.

References relevant to classification in this group

This subgroup does not cover:

If re-authentication is triggered after an intrusion	G06F 21/554
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G06F 21/31

User authentication

Definition statement

This subgroup covers:

Specific authentication aspect (e.g. initial authentication, regular authentications at predetermined time intervals, or re-authentication after logout or locking) or password design.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Authentication mechanisms	H04L 29/06755
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G06F 21/313

{using a call-back technique via a telephone network}

Definition statement

This subgroup covers:

Using characteristics specific to telephone lines.

Examples: Call-back to user phone number derived from phone network provider.

Particular cases: Authentication request triggered by server (no call-back) using phone number derived from phone network provider.

G06F 21/316

{by observing the pattern of computer usage, e.g. typical user behaviour}

Definition statement

This subgroup covers:

Authentication succeeds only when secondary user-specific authorization criteria are fulfilled at login time.

Examples: An example of secondary user-specific authorization criteria is the typing speed of the user; admit user only if this typing-speed corresponds to its normal one.

Particular cases: Maximum number of login attempts for a given user, login must be at predetermined time of day, remote login is restricted to specific computers.

References relevant to classification in this group

This subgroup does not cover:

If the typing speed is the primary authentication criteria	G06F 21/32
Observing the pattern of computer usage in order to trigger alarm and detect intrusion	G06F 21/554

G06F 21/32

using biometric data, e.g. fingerprints, iris scans or voiceprints

Definition statement

This subgroup covers:

Using physiological data intrinsic to a principal and what a principal is able to do. Examples:

- Typing/mouse clicking frequency;
- Handwritten signature.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Authenticating a user by observing the pattern of computer usage, e.g. typical user behaviour	G06F 21/316
Use of unusual or unconventional user registration	G06F 2221/2117
Authenticating a user by using biometrical features, e.g. fingerprint, retina-scan	H04L 29/06809

G06F 21/33

using certificates

Definition statement

This subgroup covers:

All authentication mechanisms implying use of a ticket, token or certificate issued by a third party upon initial user authentication. The ticket contains a proof of the initial authentication which is accepted by all parties. Examples: Kerberos, OSF DCE.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Authentication by using a single sign-on procedure provides access to a plurality of nodes	G06F 21/41
Verifying identity using certificates, signatures, hash functions and/or encryption	H04L 9/32
Authenticating by using tickets, e.g. Kerberos	H04L 29/06761
Authenticating by using certificates	H04L 29/06775

G06F 21/335

{for accessing specific resources, e.g. using Kerberos tickets}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Authentication by using a single sign-on procedure provides access to a plurality of nodes	G06F 21/41
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G06F 21/34

involving the use of external additional devices, e.g. dongles or smart cards

Definition statement

This subgroup covers:

The additional device is used for authentication with the purpose of accessing a computer system.

Particular cases: The additional device is a cryptographic processor.

References relevant to classification in this group

This subgroup does not cover:

If the additional device is used to access a program	G06F 21/123
Using hardware token other than for authentication (e.g. storing secret data)	G06F 2221/2153

Informative references

Attention is drawn to the following places, which may be of interest for search:

Authenticating by using an additional device, e.g. smartcard, SIM	H04L 29/06802
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G06F 21/35

communicating wirelessly

Definition statement

This subgroup covers:

Examples: Continuous detection of wireless authentication token carried by user. Particular cases: Wireless presence detector, logout when not present.

References relevant to classification in this group

This subgroup does not cover:

If the additional device is used to access a program	G06F 21/123
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Authenticating by using an additional device, e.g. smartcard, SIM	H04L 29/06802
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G06F 21/36

by graphic or iconic representation

Definition statement

This subgroup covers:

The graphical or iconic code is generated by a local system, a remote system or a principal.

Examples: The graphical code is used to challenge a principal and check something he should know, typically by manipulation of symbols or elements of a drawing or variation of key arrangement on a virtual keyboard.

References relevant to classification in this group

This subgroup does not cover:

Handwritten signature	G06F 21/32
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G06F 21/41

where a single sign-on provides access to a plurality of computers

Definition statement

This subgroup covers:

Using a third party performing a mapping of the credentials of the user for a first application to credentials valid for other applications.

Examples:

The third party is a password server.

The third party is a smart card. Particular cases: The third party is the first application.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Authentication using certificates	G06F 21/33
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G06F 21/42

using separate channels for security data

Definition statement

This subgroup covers:

Examples:

- Authentication with portable phone, receive sms with password, connect via fixed telephone line using password.
- Voice call for authentication, server calls back terminal.

G06F 21/44

Program or device authentication

Informative references

Attention is drawn to the following places, which may be of interest for search:

Device authentication, i.e. authenticate client device independently of the user	G06F 2221/2129
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G06F 21/445

{by mutual authentication, e.g. between devices or programs}

Informative references

Attention is drawn to the following places, which may be of interest for search:

Mutual authentication	H04L 29/06816
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G06F 21/50

Monitoring users, programs or devices to maintain the integrity of platforms, e.g. of processors, firmware or operating systems

Definition statement

This subgroup covers:

Protecting computer platforms against harmful, malicious or unexpected behaviour or activities.

This group is not strictly limited to software solutions.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Clearing memory or data when detecting an attack e.g. to prevent the data from being stolen	G06F 2221/2143
Just-in-time application of countermeasures	G06F 2221/2125
Metering, i.e. counting events for security purposes	G06F 2221/2135
Time stamp	G06F 2221/2151

Special rules of classification within this group

The difference between [G06F 21/56+](#) and the others groups [G06F 21/50+](#) (namely [G06F 21/51](#), [G06F 21/52+](#), [G06F 21/55+](#) and [G06F 21/57+](#)) may be formulated as:

- [G06F 21/56+](#): we would trust the code or system if it were not infected (we look for the infection as such)
- other groups [G06F 21/50+](#) (see definition above): we don't trust the code or system (we make an assessment of the global code or system; we don't look for an infection as such) [G06F 2221/031](#) (Protect user input by software means) and [G06F 2221/032](#) (Protect user output by software means) are additionally used to distinguish documents dealing with securing user input/output, e.g. in banking systems / applications

The subclasses [G06F 2221/03+](#) are used in combination with this group.

G06F 21/51

at application loading time, e.g. accepting, rejecting, starting or inhibiting executable software based on integrity or source reliability

Definition statement

This subgroup covers:

Accept / reject loading of application:

- onto platform for later execution.
- into memory for immediate execution.

from

- Local storage
- Remove device (e.g. By downloading).

Based on static features of the application when not being executed e.g.:

- Signature or certificate provided by application creator, provider or tester
- Integrity.
- Capability list.
- capabilities of application determined by analysis.

An application is software distinct from firmware and os such as:

- Directly executable code (binary code)
- Interpretable programs (script language)
- Interpretable files such as html, word, etc. Documents

Examples:

- Verify integrity or application origin (application creator, provider, or tester) by checking a signature, certificate, etc. of application.
- Verify integrity of application or application origin by transforming and reverse transforming the application: By analyzing user content, e.g. analyse relationship of websites referred to by a web page.
- Check application capabilities versus a predefined security policy.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Authenticating web pages	G06F 2221/2119
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G06F 21/52

during program execution, e.g. stack integrity {; Preventing unwanted data erasure; Buffer overflow}

Definition statement

This subgroup covers:

Intrusion detection at the single program level, i.e. detect intrusion of:

- A system by a single program.
- A single program.

During execution of the single program e.g. by specifically monitoring execution of the single program at the single program level

Examples:

- Transform by obfuscation means which do not add code.
- Modify code to avoid security issue when fault injection.
- Modify code to enforce security policy.
- Detect code injection

References relevant to classification in this group

This subgroup does not cover:

Transformation by addition of security routines or objects to the program	G06F 21/54
Monitoring of the whole system running many programs	G06F 21/55

G06F 21/53

by executing in a restricted environment, e.g. sandbox or secure virtual machine

Definition statement

This subgroup covers:

Intrusion detection at the environment level of the execution of the single program e.g.:

- Run program in secure, isolated environment (VM, sandbox), e.g. by modifying VM or sandbox to include special security measures
- Provide security measures in interface (library, API, OS) of program with its Environment, e.g.:
- Provide secure library or API interfacing the program
- Modify library, API or OS to include security measures
- Have OS service or library making security checks or running in protected environment

Examples: by using virtual machine, sandbox, secure library or by isolating processes at operating system level

G06F 21/54

by adding security routines or objects to programs

Definition statement

This subgroup covers:

- Transformation by addition of code to Source code
- Executable program to be loaded or already loaded in memory for execution to ensure proper execution of program
- Examples:
- Add / modify code to detect fault injection by enforcing proper execution sequence
- Modify code to detect improper execution flow when code error
- Add code to detect software attacks
- Modify code to enforce security policy
- Add code to detect code tampering in memory
- Add dummy instructions for obfuscation purposes

References relevant to classification in this group

This subgroup does not cover:

Modification of code to include some static feature (e.g. a checksum) to be checked prior to execution	G06F 21/51
Transformation of code not by addition, e.g. by obfuscation means	G06F 21/52

G06F 21/55

Detecting local intrusion or implementing counter-measures

Definition statement

This subgroup covers:

Intrusion detection at the level of the system independently of execution of one single program e.g. by monitoring execution of the whole system while running many programs.

References relevant to classification in this group

This subgroup does not cover:

Intrusion detection at the single program level during execution of the single program	G06F 21/52
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G06F 21/552

{involving long-term monitoring or reporting}

Definition statement

This subgroup covers:

Monitor the system, user actions within the system, etc., analyze the monitoring data gathered during long term and take action.

Examples:

- Determine normal user behaviour for later security issue detection
- Log security issue events for later action / risk assessment
- Collect system information and deduce security issue

G06F 21/554

{involving event detection and direct action}

Definition statement

This subgroup covers:

Monitor the system, user actions on the system, etc., immediately analyze the monitoring data gathered and directly take action.

Examples: Detect abnormal user behaviour, security issue or physical attacks; and immediately react.

Informative references

Attention is drawn to the following places, which may be of interest for search:

If the monitoring and direct action is based on data obtained by long-term monitoring	G06F 21/552
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G06F 21/556

{involving covert channels, i.e. data leakage between processes}

Definition statement

This subgroup covers:

A covert channel is defined as being a communication channel that allows a process to transfer information in a manner that violates the system's security policy.

E.g.: software measures against:

- Intended malevolent internal signalling or communication between processes on system.
- Intended malevolent external signalling or communication by process on system.
- Accidental internal leakage of data between processes on system by storage or communication
- Accidental external leakage of data of process on system by storage or communication
- Accidental internal or external leakage of system or process state or behaviour

Examples:

- Protect against physical (e.g. electromagnetic; non power consumption) monitoring to obtain information on data manipulated by the system or code executed by the system.

- Protect against fault attacks
- Data leakage between processes via common / non secure memory
Secure data transfer within processes
- Hidden communication between processes by one process observing other process behaviour
- External data leakage by hidden communication
- Unwanted data leakage in programs
- Modify code to avoid information exposure in memory

References relevant to classification in this group

This subgroup does not cover:

Software and hardware measures specifically against monitoring of power consumption (e.g. differential power attack) to obtain information about the system	G06F 21/558
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G06F 21/558

{with measures against differential power attack}

Definition statement

This subgroup covers:

Software and hardware measures against monitoring of power consumption to obtain information about the system such as differential power attack or simple power attack.

Examples:

- Hide boot order.
- Multiple processors to hide power consumption
- Algorithm design for general purpose processor
- Use special hardware logic
- Execute dummy instructions
- Randomize execution flow
- Change instruction clocking
- Hide memory / register accesses

References relevant to classification in this group

This subgroup does not cover:

Detection at the cryptographic algorithm of power analysis attacks, e.g. monitoring S-Boxes in a DES algorithm	H04L 9/0612
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Dummy operation e.g. a processor performs dummy operations as countermeasure to differential power analysis	G06F 2221/2123
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G06F 21/56

Computer malware detection or handling, e.g. anti-virus arrangements

Definition statement

This subgroup covers:

Examples:

- Protection against root kits by scanning for malwares at boot.
- Virus resistant computer by booting from authenticated read-only boot device, transfer accepted file types only.
- Determine malicious (child) processes by file generation time changes
- Remote control upon virus detection (i.e. cut communications).
- Send executable email contents to sacrificial server to verify execution for virus activity.
- Analyze file with respect to virus families, family based extraction.
- Trojans.

References relevant to classification in this group

This subgroup does not cover:

If for avoiding or detecting spam. If for virus detection in network (system) or at network protocol level	H04L 63/00
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Special rules of classification within this group

- The difference between [G06F 21/56](#) and the others subgroups under [G06F 21/50](#) (namely [G06F 21/51](#), [G06F 21/52](#), [G06F 21/55](#) and [G06F 21/57](#)) may be formulated as:
- [G06F 21/56](#): we would trust the code or system if it were not infected (we look for the infection as such).
- Other groups under [G06F 21/50](#) (see definition above): we don't trust the code or system (we make an assessment of the global code or system; we don't look for an infection as such).

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Virus	A malicious (i.e. intended to harm) executable code or script hidden or embedded in a normally non malicious data, code or system. It need not be self-replicating
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G06F 21/561

{Virus type analysis}

Definition statement

This subgroup covers:

Information relating to a specific type or family of viruses.

G06F 21/562

{Static detection}

Definition statement

This subgroup covers:

Detect presence of virus without executing directly or by emulation, except emulation for the purpose of higher level analysis (control code, data flow)

Examples of such detections:

- Analyse source code or scripts.
- Execute intermediate compiled code and analyse.
- Compile and analyse.
- Disassemble binary code and analyse control flow or data flow and/or match execution code patterns without simulation of execution.
- Validate file formats.
- Verify based on file type.

G06F 21/563

{by source code analysis}

Definition statement

This subgroup covers:

Starting point for analysis: source code, script or file type or format. The source code may be obtained by disassembly.

Informative references

Attention is drawn to the following places, which may be of interest for search:

If the source code is compiled and executed or emulated for analysis	G06F 21/566
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G06F 21/564

{by virus signature recognition}

Definition statement

This subgroup covers:

Concerns virus detection by binary or source code pattern matching or the process of enhancing the signature recognition procedure.

Examples:

- By using virus binary code signature.
- By using a virus source code pattern.

G06F 21/565

{by checking file integrity}

Definition statement

This subgroup covers:

Examples:

- Detect change of files.
- Detect change of file portions.

G06F 21/566

{Dynamic detection, i.e. detection performed at run-time, e.g. emulation, suspicious activities}

Definition statement

This subgroup covers:

Examples:

- Execute directly or by emulation and observe effect by monitoring / limitation
- Emulation of code.
- Execution in sandbox / virtual machine.
- Monitoring / limiting Inputs/Outputs.
- Monitoring memory allocation / changes

- Encoding executable and decoding upon execution such that infection is detected at run time.
- Modifying execution such that infection is detected at run time.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Access rights if detection based on access right violation	G06F 2221/2141
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Special rules of classification within this group

Use additionally [G06F 2221/033](#) (Test or assess a software) if detection at the level of execution of a single program.

Use additionally [G06F 2221/034](#) (Test or assess a computer or a system) if detection at system level (as opposed to the level of execution of a single program).

G06F 21/567

{using dedicated hardware}

Definition statement

This subgroup covers:

Use hardware specifically dealing with virus detection or removal. The hardware may be general purpose.

Examples:

- Normal boot using a general purpose external storage means (e.g. USB stick) with anti-virus software.
- Use intermediate server for virus detection.
- Use dedicated, specialized hardware means for detecting virus.
- Use dedicated, specialized hardware means for detecting suspicious activity.
- Use dedicated, specialized hardware means for alerting user upon virus detection.
- Use dedicated, specialized hardware means for avoiding virus infection by e.g. write protection.
- Use dedicated, specialized hardware means for avoiding propagation by binary transmission.

Informative references

Attention is drawn to the following places, which may be of interest for search:

If carried out on a separate, remote device (third party)	G06F 2221/2115
Use of hardware tokens, smart cards or dongles	G06F 2221/2153

G06F 21/568

{eliminating virus, restoring damaged files}

Definition statement

This subgroup covers:

Provision of software means to remove viruses or restore infected files.

Examples:

- Restore system to earlier trustworthy state.
- Apply reverse behaviour of a detected virus in order to restore file/code.
- Observe potentially harmful software on computer at runtime, remove its effects.
- Verify/scan files upon file access; replace file with clean file.
- Boot one OS to scan other OS for viruses and cleanup.

G06F 21/57

Certifying or maintaining trusted computer platforms, e.g. secure boots or power-downs, version controls, system software checks, secure updates or assessing vulnerabilities

Definition statement

This subgroup covers:

Examples:

- Validate trusted platform configuration.
- Defeat computer security by installing software into RAM using peripheral DMA.
- Receive vulnerability alert, retrieve and install patch.

References relevant to classification in this group

This subgroup does not cover:

Non secure initialization, program loading or initiating without any security aspects	G06F 9/44
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G06F 21/572

{Secure firmware programming, e.g. of basic input output system [BIOS]}

Definition statement

This subgroup covers:

Securely update, patch or load firmware or firmware modules.

Examples:

- Authenticate firmware updates, patches or modules.
- Authenticate configuration file listing updates, modules to load.
- Authenticate key to allow firmware update.
- Authenticate firmware / configuration update program / command.

G06F 21/575

{Secure boot}

Definition statement

This subgroup covers:

Examples:

- Authenticate boot code(s) at start-up.
- Verify configuration at boot.
- Pre-boot authentication (user authentication or by using unlock code authentication).
- Disable boot device
- Boot read-only system.
- Security action (e.g. Malware scan) by booting safe system in dual boot system.
- Load high security barrier code.

G06F 21/577

{Assessing vulnerabilities and evaluating computer system security}

Definition statement

This subgroup covers:

Examples:

- Analyze or test a computer or a program against vulnerabilities or threats at computer level or at program level.
- Analyze or test a computer or a program for security relevant capabilities.

References relevant to classification in this group

This subgroup does not cover:

If assessing/evaluating the network per se	H04L 63/00
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Testing software	G06F 9/44589 , G06F 11/36
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Special rules of classification within this group

Use additionally [G06F 2221/033](#) (Test or assess a software) or [G06F 2221/034](#) (Test or assess a computer or a system) to distinguish between assessment of computer or software.

G06F 21/60

Protecting data

Definition statement

This subgroup covers:

Authorizing access to an executable program using techniques specific to executable programs (e.g. manipulation of the code, manipulation of the instruction flow or data flow, security routine in the program to verify a code in a dongle) Protecting data in an environment substantially within the data owner's control (or in a non-hostile environment). The term "hostile environment" means data and operational environment of the data are controlled by different entities.

Example: non-hostile environment: FT(Financial Times) has a server where users who pay get a username+password to access FT-newspaper-articles on the server. FT has full control over the server, the data is stored on the server, and therefore the data is not in a hostile environment.

References relevant to classification in this group

This subgroup does not cover:

Protecting data in an environment substantially outside the data owner's control (or in a hostile environment)	G06F 21/10
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Recurrent verification	G06F 2221/2139
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Data	Also includes programs
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G06F 21/602

{Providing cryptographic facilities or services}

Informative references

Attention is drawn to the following places, which may be of interest for search:

For hardware details	G06F 21/72
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G06F 21/608

{Secure printing}

Definition statement

This subgroup covers:

The protection mostly relates to the secrecy, confidentiality and integrity of printed data.

Examples:

- Ensure a printed document is authentic copy of electronic document by protecting the transmission between the host and the printer. Selected for print is encrypted at the user's computer and decrypted at the printer upon user authentication at the printer, e.g. using a password or a badge.
- Ensure document can only be printed out by the intended user, e.g. by password input at printer or authentication using a smartcard containing the private key of the user.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Scanning, transmission or reproduction of documents	H04N 1/32144
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G06F 21/62

Protecting access to data via a platform, e.g. using keys or access control rules

References relevant to classification in this group

This subgroup does not cover:

If the solution is achieved via the display or its driver.	G06F 21/84
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Informative references

Attention is drawn to the following places, which may be of interest for search:

File encryption, i.e. use of unusual or unconventional encryption techniques	G06F 2221/2107
Time limited access e.g. to data	G06F 2221/2137
Access rights	G06F 2221/2141
inheriting rights or properties, e.g. propagation of permissions or restrictions across a hierarchy	G06F 2221/2145
Locking files	G06F 2221/2147
Restricted operating environment, e.g. creating a user-specific working environment, parental control	G06F 2221/2149

G06F 21/6209

{to a single file or object, e.g. in a secure envelope, encrypted and accessed using a key, or with access control rules appended to the object itself}

Definition statement

This subgroup covers:

Object access right control is performed by a dedicated application or function (separate from an optional access right control offered by the file system. Access control based on a file-system goes to [G06F 21/6218](#) and subgroups). Access rights or keys, and a security function to apply the rights, are associated directly to an individual file.

References relevant to classification in this group

This subgroup does not cover:

For access control based on a file-system	G06F 21/6218+
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G06F 21/6218

{to a system of files or objects, e.g. local or distributed file system or database}

Definition statement

This subgroup covers:

Examples:

- Access rights in databases provided by user capability lists.
- How the file system or the operating system enforce access rights.

G06F 21/6227

{where protection concerns the structure of data, e.g. records, types, queries}

Definition statement

This subgroup covers:

Examples:

- The security is at the level of records in a structured file or database, there is a field for each record dedicated to protecting this record and containing for instance a security level, access rights or encryption keys.
- The structure of the database (tables, records, views, queries, stored procedures...) is the target of the security, and by doing this the data is protected.
- Particular case : if the protection is "outside" the database, e.g. rules stored outside the DB and enforced when the DB is queried, because "outside" becomes "inside" if the security is based on database-queries.

References relevant to classification in this group

This subgroup does not cover:

Data structures not related to security	G06F 17/30
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Information retrieval (from databases and internet)	G06F 17/30
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G06F 21/6236

{between heterogeneous systems}

Definition statement

This subgroup covers:

Problem to be solved: Maintain security when exchanging data between systems with different (heterogeneous) security architectures.

G06F 21/6245

{Protecting personal data, e.g. for financial or medical purposes}

Definition statement

This subgroup covers:

Problem to be solved: Confidentiality of the personal data. General protection of personal data (e.g. encrypting all data, access rules, ...).

References relevant to classification in this group

This subgroup does not cover:

If just the link from the data to the person is protected	G06F 21/6254
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Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Personal data	any information relating to an identified or identifiable natural person
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G06F 21/6254

{by anonymising data, e.g. decorrelating personal data from the owner's identification}

Definition statement

This subgroup covers:

Protecting where the data may be accessed without revealing the person's identity, e.g. by anonymising or decorrelating" Personal Data is related to a person via a link.

Without the link, the data is no longer personal private data, and needs no further protection. Decorrelating or anonymising means partly or completely removing the link.

Examples: A hospital-server with special techniques to protect the confidentiality of patient-data, where the patient data and the sickness data are stored separately.

G06F 21/629

{to features or functions of an application}

Definition statement

This subgroup covers:

Protecting functions or features provided by specific software application like a word processor, an email client, a calendar application.

Examples: Restricting the printing function in a word processor based on access rights. Restricting entry editing in a shared calendar application.

References relevant to classification in this group

This subgroup does not cover:

If the protection is restricted to techniques specific to executables.	G06F 21/121
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Informative references

Attention is drawn to the following places, which may be of interest for search:

For access to hardware functions	G06F 21/70
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G06F 21/64

Protecting data integrity, e.g. using checksums, certificates or signatures

Definition statement

This subgroup covers:

- Protection of the integrity of data only.
- Example: A contract between two individuals where the integrity of the contract is protected.
- Particular case : If the code is not executed but transferred for collaborative programming.
- Protection of the integrity of data only.
- Examples: A contract between two individuals where the integrity of the contract is protected.

References relevant to classification in this group

This subgroup does not cover:

When code integrity is at stake or if the verification takes place in the context of protecting computer platforms against harmful, malicious or unexpected behaviour or activities	G06F 21/50
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G06F 21/645

{using a third party}

Definition statement

This subgroup covers:

Example: A notary certifies that the contract (file) is the original contract (file).

G06F 21/70

Protecting specific internal or peripheral components, in which the protection of a component leads to protection of the entire computer

Definition statement

This subgroup covers:

The hardware itself of the component must be protected; Usage of dedicated hardware to secure an entire platform, authentication, a software or data is not enough to classify here; In most cases, it is particular hardware that is protected, but a hardware solution to protecting data would also be classified here; The protected asset and/or the countermeasure to be implemented in hardware.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Just-in-time application of countermeasures	G06F 2221/2125
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G06F 21/74

operating in dual or compartmented mode, i.e. at least one secure mode

Definition statement

This subgroup covers:

Two modes of operation at processor level.

Examples: 68020 supervisor mode / user mode.

References relevant to classification in this group

This subgroup does not cover:

When dual mode in not the main aspect is of the invention	G06F 2221/2105
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G06F 21/75

by inhibiting the analysis of circuitry or operation

Definition statement

This subgroup covers:

Examples: to counter reverse engineering; Countermeasure against analysing power consumption of the microprocessor to infer which instructions are ran and retrieve statistical information about the arguments of the instructions.

References relevant to classification in this group

This subgroup does not cover:

Detection of power attacks	G06F 21/558
Countermeasures at the cryptographic algorithm level against power analysis attacks, e.g. modifying the S-Box layout in a DES algorithm	H04L 9/0612

Informative references

Attention is drawn to the following places, which may be of interest for search:

Dummy operation e.g. a processor performs dummy operations as countermeasure to differential power analysis	G06F 2221/2123
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G06F 21/77

in smart cards

Definition statement

This subgroup covers:

Only for protection of the smartcard as such.

G06F 21/78

to assure secure storage of data (address-based protection against unauthorised use of memory [G06F 12/14](#); record carriers for use with machines and with at least a part designed to carry digital markings [G06K 19/00](#))

References relevant to classification in this group

This subgroup does not cover:

Protection of disk controllers (input/output device)	G06F 21/82
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Chip on media	G06F 2221/2121
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G06F 21/79

in semiconductor storage media, e.g. directly-addressable memories

References relevant to classification in this group

This subgroup does not cover:

Secure firmware programming	G06F 21/572
Address-based protection against unauthorised use of memory	G06F 12/14
Record carriers for use with machines and with at least a part designed to carry digital markings	G06K 19/00

G06F 21/80

in storage media based on magnetic or optical technology, e.g. disks with sectors (preventing unauthorised reproduction or copying of disk-type recordable media [G11B 20/00](#))

References relevant to classification in this group

This subgroup does not cover:

Usage of defectuous sectors for copy protection	G11B 20/00086
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Preventing unauthorised reproduction or copying of disk-type recordable media	G11B 20/00
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G06F 21/805

{using a security table for the storage sub-system}

Definition statement

This subgroup covers:

Examples: Access Control Lists stored in a disk controller.

G06F 21/83

input devices, e.g. keyboards, mice or controllers thereof

Definition statement

This subgroup covers:

Examples: Keyboard with password locking mechanism embedded in the keyboard.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Biometric input devices	G06F 21/32
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G06F 21/84

output devices, e.g. displays or monitors

Definition statement

This subgroup covers:

Examples:

Protecting data shown on a display.

Hardware solution for protecting displayed data.

References relevant to classification in this group

This subgroup does not cover:

Use of password or smartcard to activate session of a printer	G06F 21/608
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G06F 21/85

interconnection devices, e.g. bus-connected or in-line devices

Definition statement

This subgroup covers:

Examples:

Encryption circuit between motherboard and hard-disk.

Device between computer components allowing/banning interconnections therebetween in accordance with user IDs; user-specific hardware configuration.

G06F 21/86

Secure or tamper-resistant housings

Definition statement

This subgroup covers:

Housing resisting tampering or housing with tamper detection means. The protection takes place at the housing level.

Examples:

- PC with housing-open detection switch.
- Tamper resistant circuit.

References relevant to classification in this group

This subgroup does not cover:

The protection takes place at the chip level	G06F 21/87
Secure enclosure, mechanical anti-theft mechanism if no computer component is protected	G08B 13/14

Informative references

Attention is drawn to the following places, which may be of interest for search:

Clearing memory, e.g. to prevent the data from being stolen	G06F 2221/2143
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G06F 21/87

by means of encapsulation, e.g. for integrated circuits

Definition statement

This subgroup covers:

The protection takes place at the chip level.

References relevant to classification in this group

This subgroup does not cover:

The protection takes place at the housing level	G06F 21/86
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G06F 21/88

Detecting or preventing theft or loss

Definition statement

This subgroup covers:

Example: Hardware locks itself / is locked when outside of RF-field.

Particular cases: Send a hardware locking message to stolen device.

Informative references

Attention is drawn to the following places, which may be of interest for search:

If the sent message is not to trigger hardware lock but to force authentication	G06F 21/305
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G06F 2221/03

Indexing scheme relating to [G06F 21/50](#), monitoring users, programs or devices to maintain the integrity of platforms

Special rules of classification within this group

This group and its lower subgroups are designed for use in combination with [G06F 21/50](#).

G06F 2221/07

Indexing scheme relating to [G06F 21/10](#), protecting distributed programs or content

Special rules of classification within this group

- This group and its lower subgroups are primarily designed for use in combination with [G06F 21/10](#), they could also be used in combination with [G06F 21/105](#) or groups under [G06F 21/12](#) if such a combination make sense.
- The general rule is to limit to the best-suited group but there could be a plurality of groups for a document if that document discloses many relevant aspects when taken separately (e.g. a document having isolated disclosures) or in combination, in particular when a combination of groups is more suited to reflect the disclosure.
- Only classify documents here if a relevant technical implementation of the concept corresponding to the class is disclosed. Example: the group [G06F 2221/0724](#) is not intended to be used to classify a document disclosing only the fact that the content could be edited or that the rights attached to content are modified. Only document disclosing a technical implementation of the way to achieve the content edition will be classified here. Documents disclosing a "basic" technical implementation or an implementation disclosed in more much details in other known documents will not be classified.

G06F 2221/0704

Device

Definition statement

This subgroup covers:

The license is bound to one rendering device the user uses e.g. mp3-player, computer, mobile phone, ...

G06F 2221/0706

Domain

Definition statement

This subgroup covers:

The license is bound to a group or type of rendering devices the user uses e.g. list, type, capabilities of devices... something the device belongs to

G06F 2221/0708**Location****Definition statement**

This subgroup covers:

The license is bound to a location

G06F 2221/0711**Token****Definition statement**

This subgroup covers:

The license is bound to something the user has e.g. token, mobile phone, recording medium, USB-stick, ... The content can be transferred from one device to another.

Glossary of terms

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Token	not rendering the content
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G06F 2221/0713**User****Definition statement**

This subgroup covers:

Binding the content to a user.

G06F 2221/0715**Characteristics****Definition statement**

This subgroup covers:

The license is bound to characteristics of the user e.g. biometrics, fingerprint, iris, behaviour.

G06F 2221/0717**Domain****Definition statement**

This subgroup covers:

The license is bound to a group the user belongs to e.g. domain, family, friends, university, library, company, ...

G06F 2221/072**Knowledge****Definition statement**

This subgroup covers:

The license is bound to something the user knows e.g. password...

G06F 2221/0724**Editing****Definition statement**

This subgroup covers:

Any editing, modifying the content by the user.

References relevant to classification in this group

This subgroup does not cover:

Personalisation of content	G06F 2221/0726
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G06F 2221/0728**Conversion****Definition statement**

This subgroup covers:

Converting content for different system requirements e.g. different Digital Right Management systems, less powerful device, interoperability, compatibility...

G06F 2221/0731

On user or administrative requirements

Definition statement

This subgroup covers:

User defined content, specifically created on user-request or business requests.

G06F 2221/0733

Watermark

Definition statement

This subgroup covers:

Watermark identifying e.g. content, user, device, ...

G06F 2221/0735

Restriction at operating system level

Definition statement

This subgroup covers:

Usage restrictions implemented at Operating System to prevent e.g. access to registers, clipboard, APIs etc.

G06F 2221/0737

Traceability

Definition statement

This subgroup covers:

Content traceability.

G06F 2221/074

Tracing pattern recognition

Definition statement

This subgroup covers:

Content can be traced without watermarks, e.g. by looking for typical pattern or properties of the specific content.

G06F 2221/0742**Enhanced product****Definition statement***This subgroup covers:*

E.g. same copy for demo version / product version.

G06F 2221/0744**Unique instance ([G06F 2221/0702](#) takes precedence)****Definition statement***This subgroup covers:*

Different protection for each instance of software, e.g. creating hardware/user specific versions, binding software to specific terminals or devices

References relevant to classification in this group*This subgroup does not cover:*

Binding	G06F 2221/0702
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G06F 2221/0746**Emerging technologies****Definition statement***This subgroup covers:*

DRM techniques that may trigger specific technology development in Digital Right Management.

G06F 2221/0748**Hiding****Definition statement***This subgroup covers:*

Hiding content, license or key e.g. inside the content, the file-system, at Operating System level, by obfuscating.

G06F 2221/0753**Distribution****Definition statement**

This subgroup covers:

Techniques of key distribution specifically designed for Digital Right Management implementation.

G06F 2221/0755**Generation****Definition statement**

This subgroup covers:

Techniques of key generation specifically designed for Digital Right Management implementation.

G06F 2221/0759**Conversion****Definition statement**

This subgroup covers:

Converting a license for e.g. different Digital Right Management system, language, version, user needs, less powerful device, interoperability, compatibility...

G06F 2221/0764**Grace period****Definition statement**

This subgroup covers:

Grace period, e.g. in offline systems the user should be able to continue for some time even if license is expired.

G06F 2221/0766**Language****Definition statement**

This subgroup covers:

How rights are defined e.g. rights definition language, grammar, syntax, semantics, graphical representation of rights, parser, right consistency...

G06F 2221/0768

Editing

Definition statement

This subgroup covers:

Modifying or creating a license for e.g. re-distributing rights, adjustment to user-needs, license changes, business requirements, circumstances, ... also including shareware where the license is updated.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Superdistribution of content	G06F 2221/0791
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Special rules of classification within this group

[G06F 2221/0791](#) has precedence.

G06F 2221/0771

Revocation

Definition statement

This subgroup covers:

Methods for revoking licenses, e.g. preventing licenses to be restored again from backup, looking after copies of the license to delete all instances of the license.

G06F 2221/0773

Recurrent authorisation

Definition statement

This subgroup covers:

Performing recurrent authorisation checks, not just at installation or loading time.

G06F 2221/0775**Logging****Definition statement**

This subgroup covers:

Logging, metering or counting e.g. copy, usage, play, transfer, move, delete, modification, time... (license logging also falls under this definition, because for logging a license is just content).

G06F 2221/0777**Return****Definition statement**

This subgroup covers:

The content or license is given back from the user/client, e.g. for floating licenses, check-in/check-out, renting, etc.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Tools for software licence management or administration	G06F 21/105
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G06F 2221/0782**Backup or restore****Definition statement**

This subgroup covers:

Techniques for allowing, supporting or preventing backup/restore specifically designed for DRM.

G06F 2221/0784**Fragments****Definition statement**

This subgroup covers:

Transferring fragments of content / licence for:

- Payment: shareware, part of the content/license is send after payment.
- Optimisation: incremental, differential, update... The fragment alone is not sufficient for rendering

G06F 2221/0786**Indirect via third party****Definition statement***This subgroup covers:*

Third party with special Digital Right Management aspects (e.g. third party generates and stores part of the key). The third party is not only transferring data.

G06F 2221/0788**Peer-to-Peer [P2P]****Definition statement***This subgroup covers:*

Digital Right Management systems especially adapted to peer-to-peer solutions.

References relevant to classification in this group*This subgroup does not cover:*

Peer to peer in general	H04L 29/06
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G06F 2221/0791**Superdistribution****Definition statement***This subgroup covers:*

Permitting further distribution of digital content, e.g. from user to user, but still maintaining some control over re-distributed copies. License editing is frequently implied and the corresponding keyword is not necessary.

Informative references*Attention is drawn to the following places, which may be of interest for search:*

License editing	G06F 2221/0768
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Special rules of classification within this group

[G06F 2221/0768](#) is frequently implied and should not be given ([G06F 2221/0791](#) has precedence).

G06F 2221/0793**Synchronisation****Definition statement**

This subgroup covers:

Synchronisation between :

- (License)server: master/slave; or
- Between local and distant license.

Comprises also offline usage.

G06F 2221/0795

Transaction with ACID [Atomicity, Consistency, Isolation and Durability] properties

Definition statement

This subgroup covers:

In an atomic transaction, a series of operations either all occur, or all do not occur (wish of content owners).

G06F 2221/0797

using dedicated hardware at the client

References relevant to classification in this group

This subgroup does not cover:

Restricting unauthorised execution of programs by using dedicated hardware	G06F 21/123
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G06F 2221/21

Indexing scheme relating to [G06F 21/00](#) and subgroups addressing additional information or applications relating to security arrangements for protecting computers, components thereof, programs or data against unauthorised activity

Definition statement

This subgroup covers:

Secondary and transversal aspects to [G06F 21/00](#).

Special rules of classification within this group

[G06F 2221/03](#) Secondary and transversal aspects specific to [G06F 21/50+](#)

[G06F 2221/07](#) Secondary and transversal aspects specific to [G06F 21/10+](#)

G06F 2221/2101

Auditing as a secondary aspect

Definition statement

This subgroup covers:

Logging history of events.

References relevant to classification in this group

This subgroup does not cover:

When the main aspect of the invention is auditing or monitoring	G06F 21/552 , G06F 21/554
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G06F 2221/2103

Challenge-response

Informative references

Attention is drawn to the following places, which may be of interest for search:

Authentication	G06F 21/30
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G06F 2221/2105

Dual mode as a secondary aspect

Definition statement

This subgroup covers:

Computer working in two or more modes, e.g. protecting platform using secure/non secure mode, user/administrator mode.

References relevant to classification in this group

This subgroup does not cover:

When the main aspect of the invention relates to protecting specific internal components or peripheral devices operating in dual or compartmented mode.	G06F 21/74
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G06F 2221/2107**File encryption****Definition statement**

This subgroup covers:

Use of unusual or unconventional encryption techniques.

G06F 2221/2109**Game systems****Definition statement**

This subgroup covers:

Specific solutions for security of games within the context of [G06F 21/00](#), e.g. special memory game cartridge, casino machines.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Coin-freed apparatus for games, toys, sports or amusements	G07F 17/32
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G06F 2221/2115**Third party****Definition statement**

This subgroup covers:

When the involvement of a third party is essential.

G06F 2221/2117**User registration****Definition statement**

This subgroup covers:

Use of unusual or unconventional user registration.

G06F 2221/2119**Authenticating web pages, e.g. with suspicious links****Informative references***Attention is drawn to the following places, which may be of interest for search:*

Protecting computer platforms against harmful, malicious and unexpected behaviours or activities at application loading time	G06F 21/51
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G06F 2221/2123**Dummy operation****Definition statement***This subgroup covers:*

e.g. a processor performs dummy operations as countermeasure to differential power analysis.

G06F 2221/2127**Bluffing****Definition statement***This subgroup covers:*

e.g. pretending to have connected a user to a real node when in fact the connection is to a dummy.

G06F 2221/2135**Metering****Definition statement***This subgroup covers:*

Counting events for security purposes.

References relevant to classification in this group*This subgroup does not cover:*

Metering	G06F 2221/0775
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Auditing	G06F 2221/2101
Long-term monitoring or reporting	G06F 21/552
Monitoring involving event detection and direct action	G06F 21/554

G06F 2221/2139

Recurrent verification

Definition statement

This subgroup covers:

Periodically carrying out authorization checks after initial installation or loading.

References relevant to classification in this group

This subgroup does not cover:

when the main aspect of the invention is recurrent authorisation	G06F 2221/0773
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G06F 2221/2145

Inheriting rights or properties, e.g., propagation of permissions or restrictions within a hierarchy

Informative references

Attention is drawn to the following places, which may be of interest for search:

Protecting data against unauthorised access or modification by protecting access to a system of files or objects	G06F 21/6218
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G06F 2221/2147

Locking files

Definition statement

This subgroup covers:

Concurrent access, collaborative control, e.g. when two users with different access rights concurrently edit the same document.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Protecting data against unauthorised access or modification by protecting access	G06F 21/62
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G06F 2221/2149

Restricted operating environment

Definition statement

This subgroup covers:

E.g. creating a user-specific working environment, parental control.

G06F 2221/2153

Using hardware token as a secondary aspect

Definition statement

This subgroup covers:

Use of hardware tokens, smart cards or dongles.

References relevant to classification in this group

This subgroup does not cover:

When for purposes of authentication	G06F 21/34
When used for restricting or protecting executable software	G06F 21/123